



MASS BALANCE OPTIMIZATION

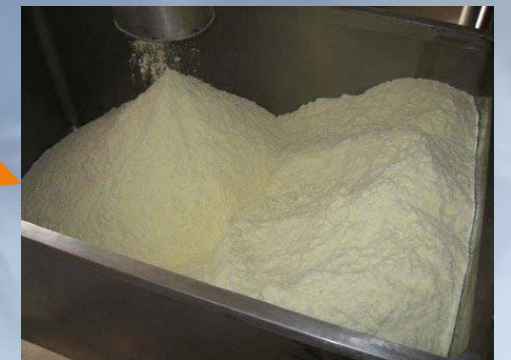
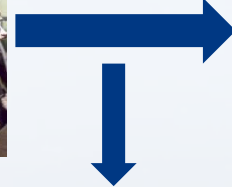
Why are some dairy processors more profitable than others?

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VP Business Development, MSc., PhD

9/21/2022 – St. Cloud, MN

DAIRY VALUE CHAIN



PRODUCER TESTING INSIGHT

Daily historical deviation report



Dairy: xxx

Date: 05-01-2018

Herd ID Pass/Fail

- 12554 ●
- 13554 ●
- 14587 ●
- 15887 ●
- 19885 ●
- 21544 ●
- 24775 ●
- 32214 ●
- 33548 ●
- 34885 ●
- 36555 ●
- 37865 ●
- 38554 ●
- 39955 ●
- 45521 ●
- 48555 ●
- 49225 ●
- 49558 ●
- 54474 ●
- 55448 ●
- 55988 ●
- 56442 ●
- 57544 ●
- 58554 ●
- 59442 ●
- 60442 ●
- 61220 ●
- 61514 ●
- 61852 ●
- 62458 ●
- 63597 ●
- 63852 ●
- 63957 ●
- 64587 ●
- 64875 ●
- 64952 ●
- 66521 ●
- 66750 ●
- 66800 ●
- 67123 ●
- 67234 ●

Herd ID Pass/Fail

- 67625 ●
- 67852 ●
- 68774 ●
- 69322 ●
- 69542 ●
- 70412 ●
- 70524 ●
- 70678 ●
- 70954 ●
- 72042 ●
- 73521 ●
- 73852 ●
- 74589 ●
- 75894 ●
- 75412 ●
- 76541 ●
- 79654 ●
- 75418 ●
- 76541 ●
- 77000 ●
- 77125 ●
- 77354 ●

Details of herds with deviations can be found on the following page(s).

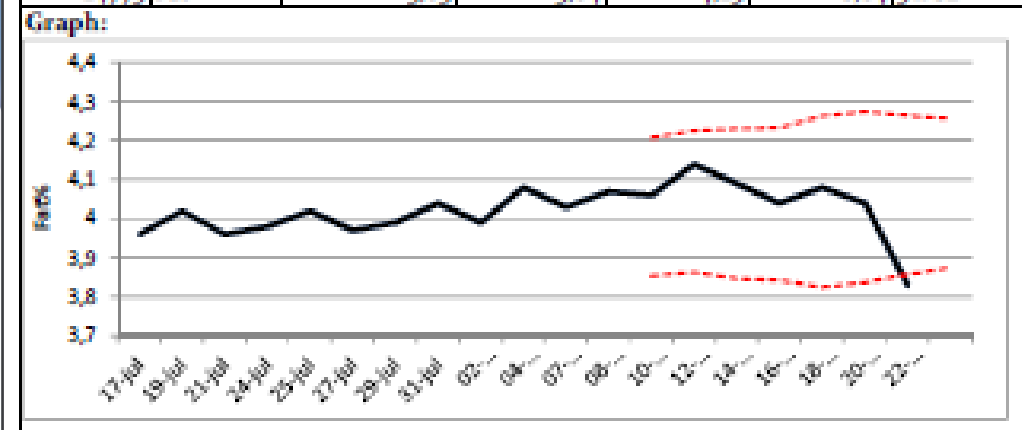
Daily historical deviation report



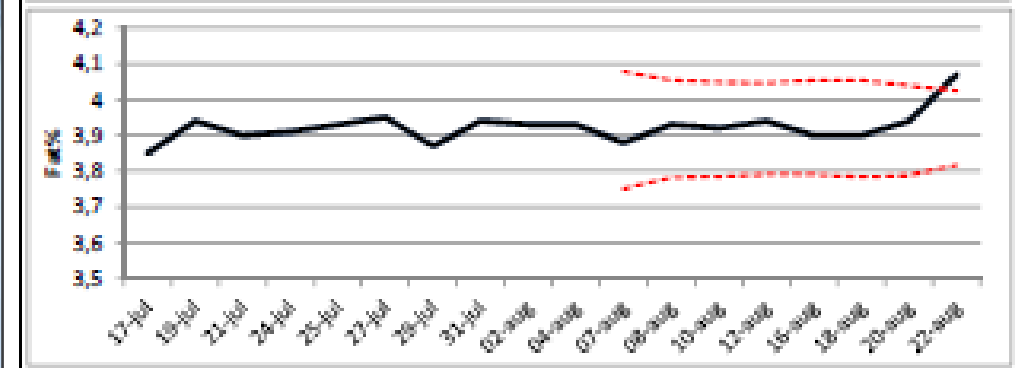
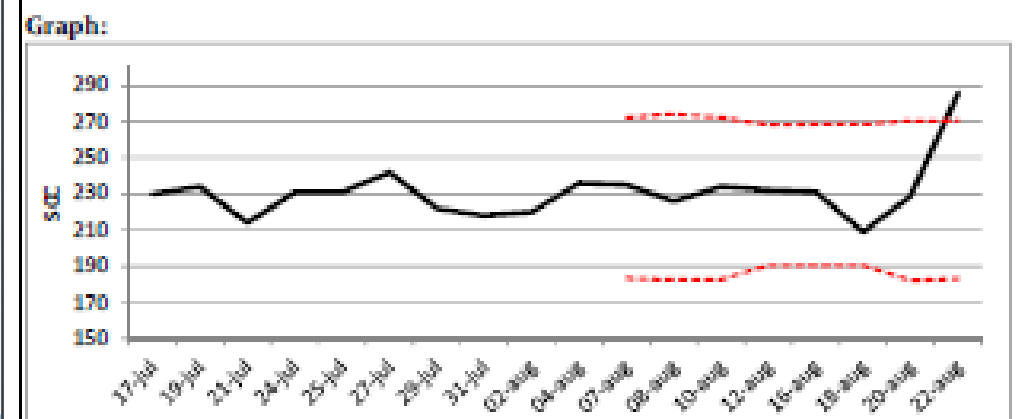
Customer: xxx

Date: 05-01-2018

Producer	Parameter	Current value	Lower limit	Upper limit	SD(10)	Allowance
24775	Fat	3,83	3,84	4,25	0,04	5 x SD

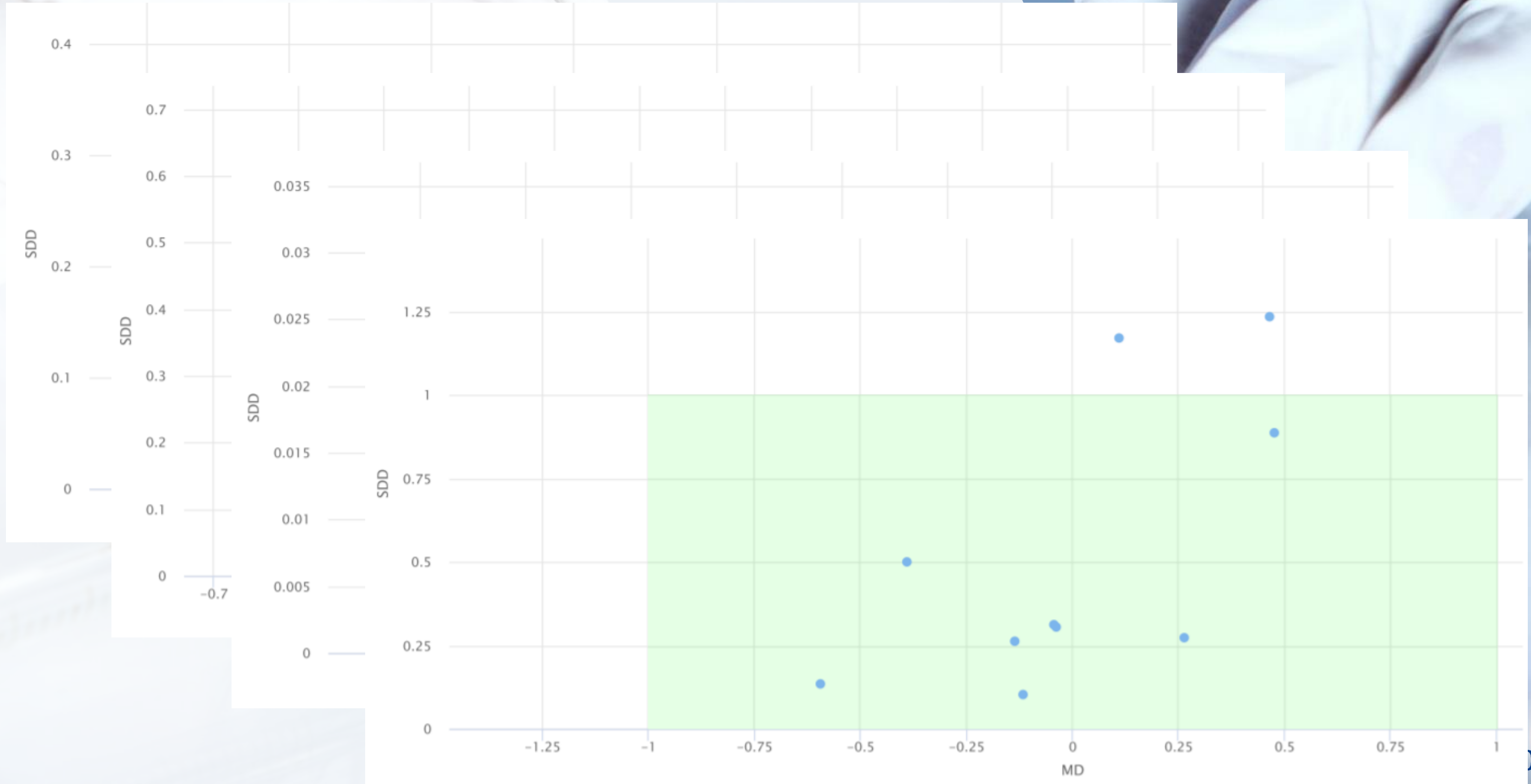


Producer	Parameter	Current value	Lower limit	Upper limit	SD(10)	Allowance
69322	SCC	286	183	271	8,78	5 x SD
69322	Fat	4,07	3,82	4,02	0,02	5 x SD





BUILDING MODELS



INTAKE

1.3M lbs. Milk per day:

3.5% protein: 45,500 lbs. Protein/day (80% caseinates, 20 % whey)

4.4% fat: 57.200 lbs fat/day

Per year:

16.2M lbs protein (13M lbs caseins, 3.24M lbs. Whey), 20.8M lbs fat

Fluid milk			
Protein			
FT1	Ref. Chem (True value)	Diff.	
3.85	3.81	0.04	
3.73	3.72	0.01	
3.82	3.77	0.05	
3.88	3.85	0.03	
3.85	3.84	0.01	
3.97	3.91	0.06	
3.92	3.9	0.02	
3.85	3.82	0.03	
3.82	3.77	0.05	
3.86	3.79	0.07	
3.88	3.82	0.06	

OUTPUT

Whole milk, Skim (fat free) milk, heavy cream

BB Date	Plant#	Protein	Fat	Min req.	Res. (waste)	P dec.	P diff.
21-SepA		3.43%	0.09%	0.50%	-0.41%	3.33%	0.10%
6-SepA		3.35%	0.12%	0.50%	-0.38%	3.33%	0.02%
16-SepA		3.39%	0.11%	0.50%	-0.39%	3.33%	0.06%
4-SepA		3.44%	0.10%	0.50%	-0.40%	3.33%	0.11%
13-SepA		3.36%	3.25%	3.25%	0.00%	3.33%	0.03%
9-SepB		3.32%	3.35%	3.25%	0.10%	3.33%	-0.01%
18-SepB		3.27%	3.25%	3.25%	0.00%	3.33%	-0.06%
12-SepB		3.23%	3.38%	3.25%	0.13%	3.33%	-0.10%
28-OctB		1.95%	39.42%	36%	3.42%	0.00%	1.95%
24-OctB		1.78%	38.86%	36%	2.86%	0.00%	1.78%
19-OctB		1.88%	38.80%	36%	2.80%	0.00%	1.88%
25-OctB		1.82%	40.56%	36%	4.56%	0.00%	1.82%
9-SepC		3.31%	3.27%	3.25%	0.02%	3.33%	-0.02%
12-SepC		3.21%	3.28%	3.25%	0.03%	3.33%	-0.12%
8-SepC		3.29%	0.07%	0.50%	-0.43%	3.33%	-0.04%
15-OctD		1.97%	36.31%	36%	0.31%	0.00%	1.97%
3-OctD		1.92%	36.23%	36%	0.23%	0.00%	1.92%
14-OctD		1.97%	36.39%	36%	0.39%	0.00%	1.97%

Absolute values		
Per plant	Av. Res. F	Av res. P
A	-0.32%	0.06%
B	1.98%	1.04%
C	-0.13%	-0.06%
D	0.31%	1.95%

Av. Daily loss:

Intake loss: F&P av. -0.03% = \$16,400

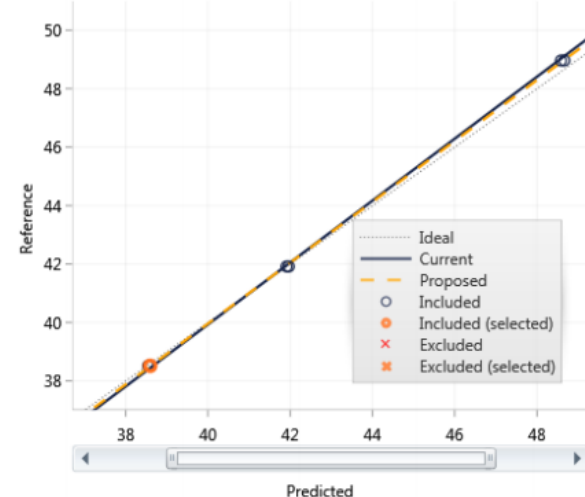
Output loss: F&P av. -0.3% = \$78,800

<https://www.ams.usda.gov/mnreports/dymawpc.pdf>

MASS BALANCE OPTIMIZATION- CALIBRATION REPORTING

Calibration reporting and acceptance criteria on various products

PRODUCT: CREAM, DOUBLE

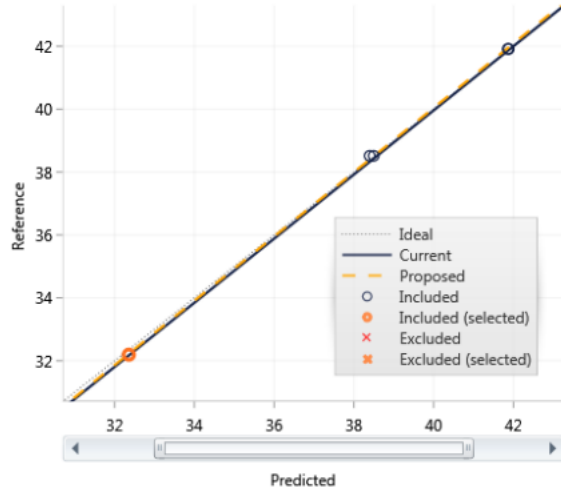


PARAMETER: FAT

	Current	Proposed
Slope	1.059	1.041
Intercept	-2.442	-1.674
Accuracy (abs)	0.099	0.070
Accuracy (rel)	0.23	0.16
Repeatability	0.05	0.05
Correlation	1.000	
Validation SEP		

Recommendation: **Accept**

PRODUCT: CREAM, WHIPPING



PARAMETER: FAT

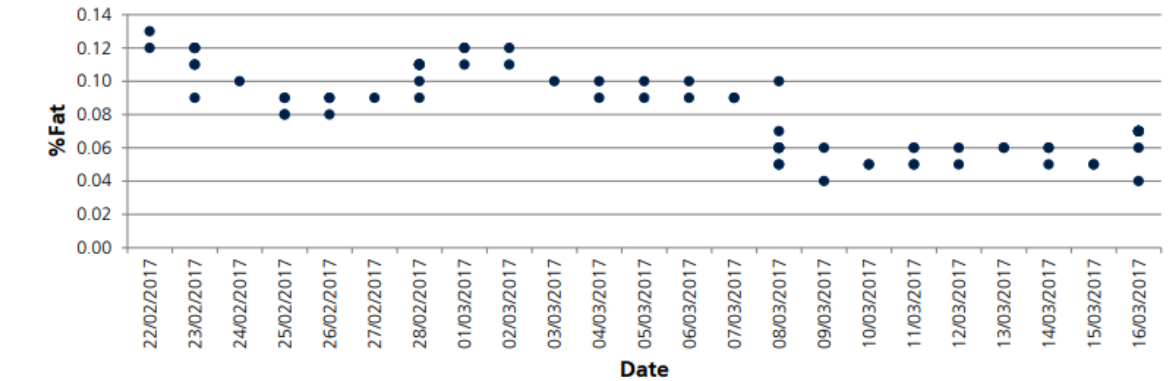
	Current	Proposed
Slope	1.020	1.023
Intercept	-0.836	-0.882
Accuracy (abs)	0.094	0.068
Accuracy (rel)	0.25	0.18
Repeatability	0.04	0.04
Correlation	1.000	
Validation SEP		

Recommendation: **Accept**

Pilot samples monitoring and acceptance criteria

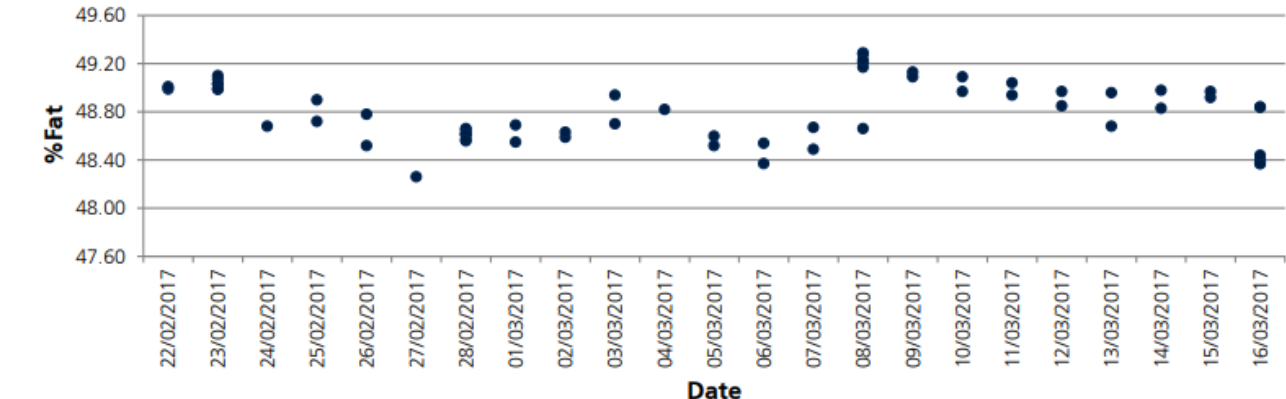
PILOT SAMPLES

PRODUCT: MILK, SKIM



PARAMETER: FAT

PRODUCT: CREAM, DOUBLE



PARAMETER: FAT

MOST FREQUENT REASONS FOR MIS-ALIGNED MASS BALANCE

- Traceability of lab performance – using two/three different (external) lab sources which are not aligned.
- Poorly described SOPs for sampling, frequency, size, parameters, and acceptance criteria.
- Lack of adequate training and understanding between production and QA/QC.
- No proper tools for monitoring mass balance as a part of components in stead of \$\$\$.

Thank you!