CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Portland Cement Proficiency Samples
Number 177 and Number 178

September 2010

CCRL CEMENT AND CONCRETE REFERENCE LABORATORY

CCRL
Cement and Concrete Reference Laboratory

www.ccrl.us

September 10, 2010

TO: Participants in the CCRL Portland Cement Proficiency Sample Program

SUBJECT: Final Report on Portland Cement Proficiency Samples No. 177 and No. 178

Following is the final report for the current pair of CCRL **Portland Cement** Proficiency Samples which were distributed in July 2010. Portland Cement Samples No. 177 and No. 178 were ASTM C150 cements with limestone additions meeting the specifications of Type I and Type II.

This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with individualized information for participating laboratories can be downloaded at our website located at: http://ccrl.us/. Additional information is provided in the following pages.

C1702 Heat of Hydration by Isothermal Conduction Calorimetry: No laboratory ratings were assigned for this test method due to the small number of test results.

The CCRL Proficiency Sample Programs are intended for internal use by the laboratory as a tool to identify potential problems in laboratory procedures or test equipment and to initiate remedial actions. These programs are designed to complement the CCRL Laboratory Inspection Program as part of a total quality system. Care should be taken when using this program for any other purpose.

Additional samples of these two cements and other CCRL samples are available for purchase. These samples may be useful for equipment verification, technician training, and research. Contact CCRL for availability and price.

It is presently anticipated that the next Portland Cement Proficiency Samples will be distributed in January 2011.

Sincerely,

Robin K. Haupt

Robin K. Haupt
Supervisor, Proficiency Sample Programs
Cement and Concrete Reference Laboratory

TO: Participants in the CCRL Portland Cement Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor, PSP

SUBJECT: Explanation of Final Report on Results of Tests for Portland Cement Proficiency Samples No. 177 and No. 178

This letter, and the material included with it, constitute the final report, and summary of results for the current pair of Portland Cement Proficiency Samples, which were distributed in July 2010. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of general Scatter Diagrams. Your unique laboratory number is displayed at the top of the individual Table of Results.

An explanation of the program is contained in the paper: "Statistical Evaluation of Interlaboratory Cement Tests" by J. R. Crandall and R. L. Blaine View document, and "Statistical Aspects of the Cement Testing Program" by W.J. Youden View document, which can be found in Volume 59, Proceedings of the 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.

Each laboratory receives an individualized Table of Results. The Table of Results shows the, test title, and the reporting unit in the first two columns. After that it lists in order, the laboratory's results for the odd and even numbered samples, overall averages for the odd and even numbered samples, and the laboratory's ratings for the odd and even samples.

Laboratory ratings, shown in the Table of Results for the individual laboratory, were determined in the manner described by Crandall and Blaine using a rating scale of 1 to 5 instead of 0 to 4. The ratings have no valid standing beyond showing the difference between the individual laboratory result and the average for a particular test.

The following table details the relationship between the ratings and the averages.

Ratings	Range (Number of Standard Deviations)	Number (Per 100) of Laboratories achieving the rating [1]
5	Less than 1	69
4	1 to 1.5	18
3	1.5 to 2	9
2	2 to 2.5	3
1	Greater than 2.5	1

The sign of the rating merely shows whether the result reported was greater or less than the average obtained.

Participants subscribing to the primary chemical analysis portion of this report should note that the statistics were calculated using data obtained by wet methods, and rapid methods of chemical analysis. Participants in the secondary chemical analysis should note that laboratory ratings are assigned using primary chemical statistics.

Please note that individual laboratory ratings were not given for the flow of air content mortar (test no. 190) and compressive strength mortar (test no. 230). Air content flows in the range of 87.5 ± 7.5 are satisfactory,

[1]Youden, W.J., "Statistical Aspects of the Cement Testing Program",Volume 59, *Proceedings of the 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.*

labs with flow values outside this range will be flagged as a “Labs Eliminated” or “Labs Off Diagram” on the scatter diagram. Averages, standard deviations, and a scatter diagram are provided for your information. This information may be a helpful indicator of a problem with flow table apparatus or mortar mixing procedures. Flow values of 151 were assigned to laboratories reporting a mortar flow off the flow table top.

In cases where some laboratories' results are eliminated, averages, standard deviations, coefficients of variation, and the ratings of the other laboratories' results, are recalculated using the data remaining after the elimination. Since the laboratory ratings given are the results from this one series of tests, you need not attach too much significance to a single low rating, or pair of ratings, from this one series. A continuing tendency to get low ratings on several pairs of samples should lead a laboratory to consider the types of error, systematic and random, contribute to ratings that are low. Systematic error, which is indicated by low ratings with the same signs on each pair of samples, means a consistent error is occurring in equipment and/or test procedures. One indication of random error is low ratings on both samples with different signs. Since systematic error occurs with more regularity, its cause is generally easier to find than the cause of random error.

Summary of Results

Usually, averages, standard deviations, and coefficients of variation are given with all results reported, and then with one or more outlying results omitted. Sometimes, two or more recalculations with laboratories omitted, have been done for the same test. In these cases, all of the laboratories omitted in previous recalculations are also omitted in subsequent ones. Results omitted are values that are more than three standard deviations from the mean of one or both samples. Often, elimination of these outlying results has little effect on the average, but may have a more pronounced effect on the standard deviation and coefficient of variation.

Scatter Diagrams

General scatter diagrams are supplied with this report. Crandall and Blaine describe the manner of preparing scatter diagrams, and their interpretation, in the paper published in the 1959 ASTM Proceedings. Each laboratory will receive a complete set of diagrams according to their subscription to the given program.

Using the results received from each laboratory, a scatter diagram is generated for each test method by plotting the value for the odd numbered samples on the *X*, or horizontal axis, against the value for the even numbered samples on the *Y*, or vertical axis. To find your point, just plot as you would when plotting any scatter diagram. Vertical and horizontal dashed lines, which divide the diagrams into four sections or quadrants, place the average values for the odd and even numbered samples, respectively. The first line of print under the diagram includes the test number, as given on the data sheet, the test title, and the number of data points on the diagrams. The number of plotted points may not agree with the total number of data pairs included in the analysis because a few points may be off the diagram, and some points may represent several data pairs, which are identical. Laboratories whose points are off the diagram will have a rating of ±1 for that particular test. As described in Crandall and Blaine, a tight circular pattern of points around the intersection of the median lines is the ideal situation. Stretching out of the pattern into the first (upper right) and third (lower left) quadrants, suggests some kind of bias, or tendency for laboratories to get high or low results on both samples. Examination of the scatter diagrams indicates strong evidence of bias on many tests.

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 177 and No. 178
Final Report - Chemical Results
September 10, 2010

SUMMARY OF RESULTS

Test		#Labs	Sample No. 177 Average	S.D.	C.V.	Sample No. 178 Average	S.D.	C.V.
Silicon Dioxide	%	227	20.64	1.20	5.9	19.46	1.20	6.0
Silicon Dioxide	%	* 213	20.72	0.14	0.7	19.53	0.24	1.2
Aluminum Oxide	%	222	4.45	0.13	3.0	4.43	0.15	3.5
Aluminum Oxide	%	* 216	4.46	0.10	2.3	4.44	0.11	2.5
Ferric Oxide	%	224	2.88	0.08	2.9	3.11	0.21	6.9
Ferric Oxide	%	* 213	2.87	0.04	1.4	3.09	0.05	1.5
Calcium Oxide	%	222	63.61	0.45	0.7	63.64	0.94	1.5
Calcium Oxide	%	* 213	63.58	0.33	0.5	63.68	0.42	0.7
Magnesium Oxide	%	223	2.26	0.13	5.7	2.49	0.15	6.1
Magnesium Oxide	%	* 211	2.26	0.06	2.5	2.50	0.07	3.0
Sulfur Trioxide	%	227	2.70	0.15	5.6	3.36	0.21	6.2
Sulfur Trioxide	%	* 213	2.70	0.07	2.5	3.38	0.08	2.4
Loss on Ignition	%	226	2.13	0.17	8.0	2.71	0.22	8.2
Loss on Ignition	%	* 214	2.12	0.10	4.8	2.72	0.12	4.3
Sodium Oxide	%	213	0.180	0.047	26.1	0.123	0.044	35.5
Sodium Oxide	%	* 198	0.175	0.023	13.2	0.120	0.023	19.3

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* ELIMINATED LABS: Data over three S.D. from the mean

Silicon Dioxide 4 26 51 93 289 407 696 779 28 52 768 1594 3059 3428

Aluminum Oxide 26 38 52 289 407 3454

Ferric Oxide 26 407 2464 95 206 289 502 696 736 2491 3454

Calcium Oxide 23 50 407 2621 289 2464 3059 3428 3454

Magnesium Oxide 53 289 407 416 95 206 696 1594 1644 2463 2466 3454

Sulfur Trioxide 51 53 407 696 4 40 156 416 501 1956 2305 2483 3279 3454

Loss on Ignition 51 90 203 1644 2491 2763 206 221 431 1466 3059 3415

Sodium Oxide 53 78 98 110 125 1053 1251 4 458 696 1956 2463 2464 3057 3238

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 177 and No. 178
Final Report - Chemical Results
September 10, 2010

SUMMARY OF RESULTS

Test		#Labs	Sample No. 177 Average	S.D.	C.V.	Sample No. 178 Average	S.D.	C.V.
Potassium Oxide	%	218	0.556	0.022	4.0	0.493	0.028	5.6
Potassium Oxide	%	* 201	0.559	0.013	2.2	0.496	0.014	2.8
Titan Dioxide	%	178	0.32	0.016	5.1	0.24	0.022	8.8
Titan Dioxide	%	* 171	0.32	0.012	3.7	0.24	0.009	3.5
Phosphorus Pent	%	175	0.142	0.022	15.8	0.092	0.018	19.7
Phosphorus Pent	%	* 163	0.141	0.008	5.7	0.090	0.008	8.6
Zinc Oxide	%	81	0.028	0.007	24.2	0.007	0.006	84.9
Zinc Oxide	%	* 74	0.027	0.003	10.1	0.006	0.003	41.3
Manganic Oxide	%	133	0.038	0.006	15.3	0.028	0.015	54.2
Manganic Oxide	%	* 127	0.038	0.004	9.2	0.026	0.004	14.8
Chloride	%	113	0.008	0.011	135	0.014	0.010	72.0
Chloride	%	* 109	0.007	0.004	54.7	0.014	0.006	42.7
Insoluble Residue	%	212	0.41	0.11	27.6	0.30	0.13	43.9
Insoluble Residue	%	* 208	0.40	0.10	23.8	0.29	0.09	32.1
Free Lime	%	171	0.61	0.21	34.3	1.25	0.27	21.9
Free Lime	%	* 166	0.59	0.18	29.8	1.26	0.25	20.1

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* ELIMINATED LABS: Data over three S.D. from the mean

Potassium Oxide 36 158 178 407 416 2463 3233 3415 1 107 206 696 768 1190 2253 3057 3454

Titanium Dioxide 84 107 53 407 696 768 2491

Phosphorus Pentoxide 92 98 1799 2116 4 53 107 139 696 2463 2484 3291

Zinc Oxide 74 95 206 408 696 1466 2934

Manganic Oxide 162 181 354 407 692 2463

Chloride 181 206 457 3428

Insoluble Residue 206 605 3415 3454

Free Lime 284 494 2363 2490 3235

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 177 and No. 178
Final Report - Chemical Results
September 10, 2010

SUMMARY OF RESULTS

Test		#Labs	Sample No. 177 Average	S.D.	C.V.	Sample No. 178 Average	S.D.	C.V.
Carbon Dioxide	prcnt	180	1.50	0.21	14.1	1.26	0.25	20.1
Carbon Dioxide	prcnt	* 175	1.53	0.17	11.1	1.27	0.23	18.3
Limestone	prcnt	177	3.7	0.6	15.0	3.2	0.7	20.5
Limestone	prcnt	* 171	3.7	0.4	11.4	3.2	0.6	18.8
Chromium Oxide	%	78	0.011	0.005	44.8	0.007	0.003	43.0
Chromium Oxide	%	* 75	0.010	0.003	30.4	0.007	0.003	36.7
(1)Tricalcium Silicate	%	168	53.5	4.1	7.7	61.5	4.4	7.1
(1)Tricalcium Silicate	%	* 163	53.2	3.6	6.8	61.5	3.5	5.7
(1)Dicalcium Silicate	%	168	18.9	3.4	18.0	9.3	3.3	35.7
(1)Dicalcium Silicate	%	* 165	19.0	3.1	16.4	9.4	2.9	31.2
Tricalc Aluminate	%	194	6.9	0.4	5.6	6.5	0.4	6.2
Tricalc Aluminate	%	* 186	7.0	0.3	3.6	6.5	0.3	4.5
Tetracalc Alumino	%	191	8.8	1.0	11.5	9.6	1.3	13.2
Tetracalc Alumino	%	* 181	8.7	0.2	1.8	9.4	0.2	1.8

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* ELIMINATED LABS: Data over three S.D. from the mean

Carbon Dioxide 56 66 162 975 2466

Limestone Content 56 66 162 975 2466 2477

Chromium Oxide 415 1956 2462

Tricalcium Silicate 8 407 2463 2477 2621

Dicalcium Silicate 93 2463 2621

Tricalcium Aluminate 124 289 2464 2491 38 975 2463 3454

Tetracalcium Aluminoferrite 66 209 124 206 289 407 504 696 2491 3454

NOTES:

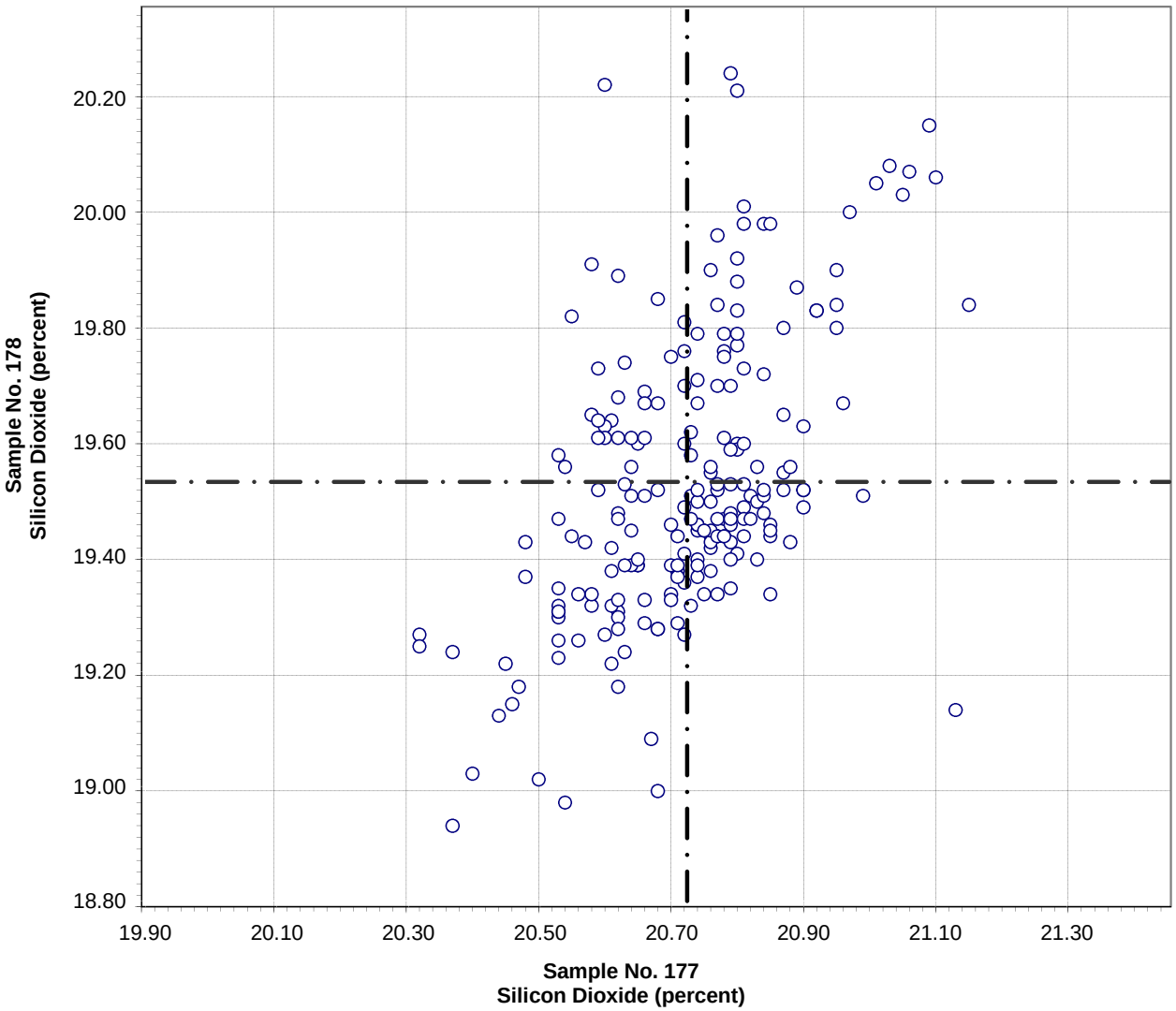
(1) Tricalcium silicate and Dicalcium silicate - ASTM C150 requires that cements containing limestone additions use CO_2 in the calculation of these two phases. Samples 177 and 178 contain limestone additions, therefore, test results of 23 laboratories not determining CO_2 were not used in calculating the statistics. See the following list of excluded labs.

Test Results Not Used in Calculating Statistics for Tricalcium Silicate and Dicalcium Silicate

List of laboratories reporting test results for tricalcium silicate and dicalcium silicate but did not report values for CO_2 .

2	557
10	696
53	1799
80	2021
90	2464
95	2482
98	2484
110	2491
181	3279
206	3454
289	3577
497	

CCRL Proficiency Sample Program
Silicon Dioxide
PORTLAND CEMENT Samples No. 177 and No. 178

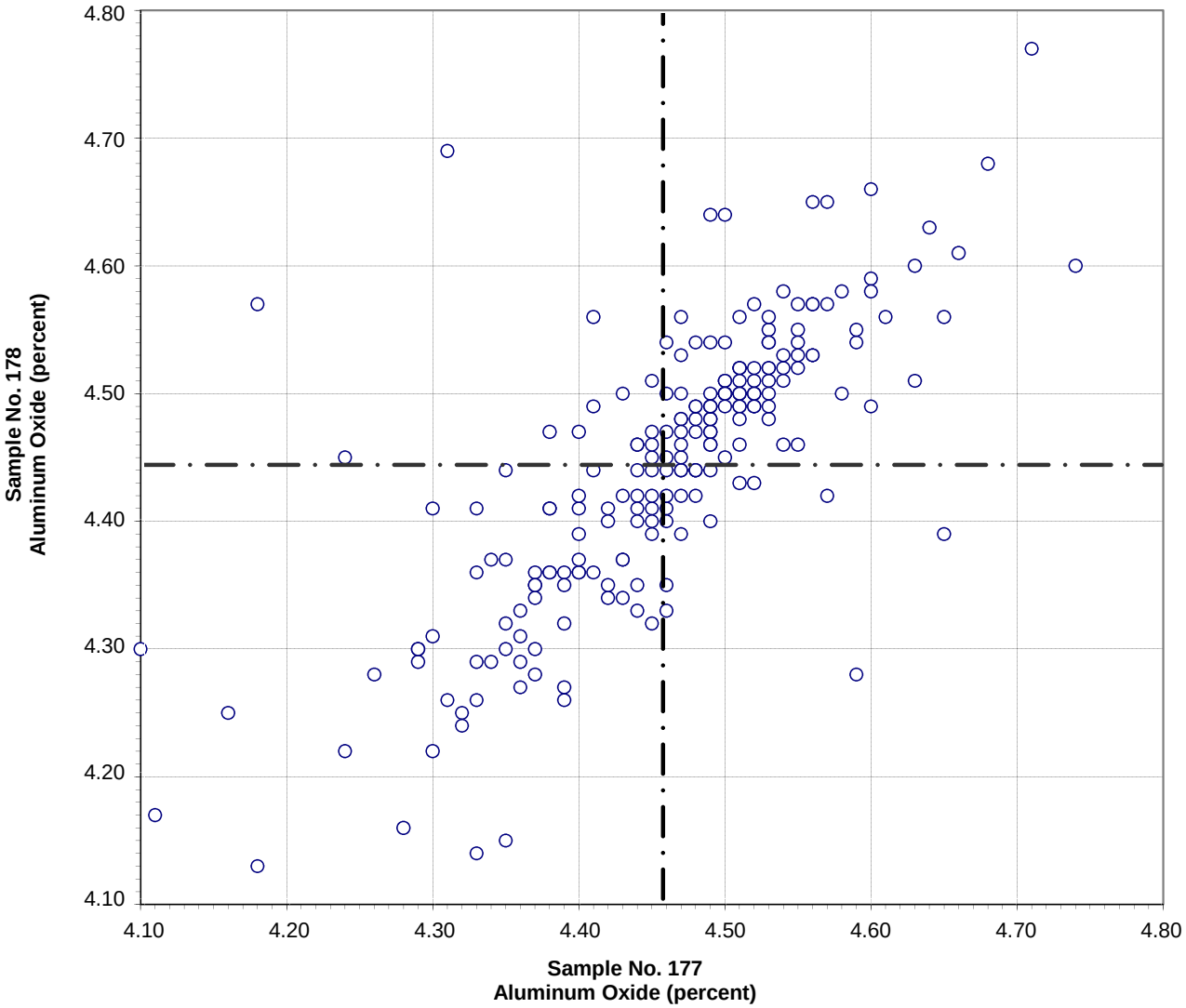


Test No. 10 Silicon Dioxide 213 Points

Sample No. 177	Ave	20.72	S.D.	0.14	C.V.	0.7
Sample No. 178	Ave	19.53	S.D.	0.24	C.V.	1.2

Labs eliminated: 4, 26, 51, 93, 289, 407, 696, 779, 28, 52, 768, 1594, 3059, 3428

CCRL Proficiency Sample Program
Aluminum Oxide
PORTLAND CEMENT Samples No. 177 and No. 178



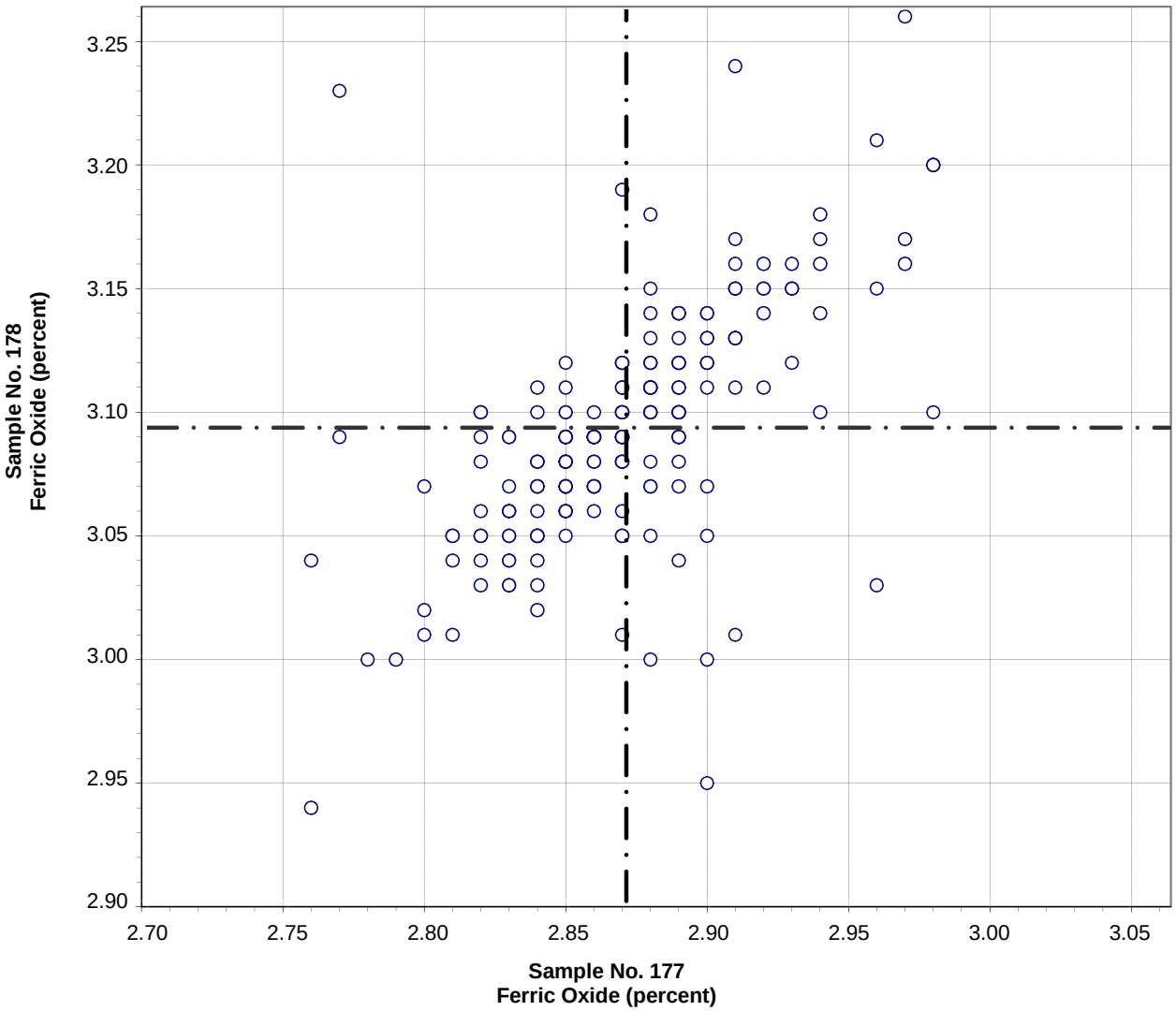
Test No. 21 Aluminum Oxide 215 Points

Sample No. 177	Ave	4.46	S.D.	0.10	C.V.	2.3
Sample No. 178	Ave	4.44	S.D.	0.11	C.V.	2.5

Labs eliminated: 26, 38, 52, 289, 407, 3454

Labs off Diagram: 2463

CCRL Proficiency Sample Program
Ferric Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

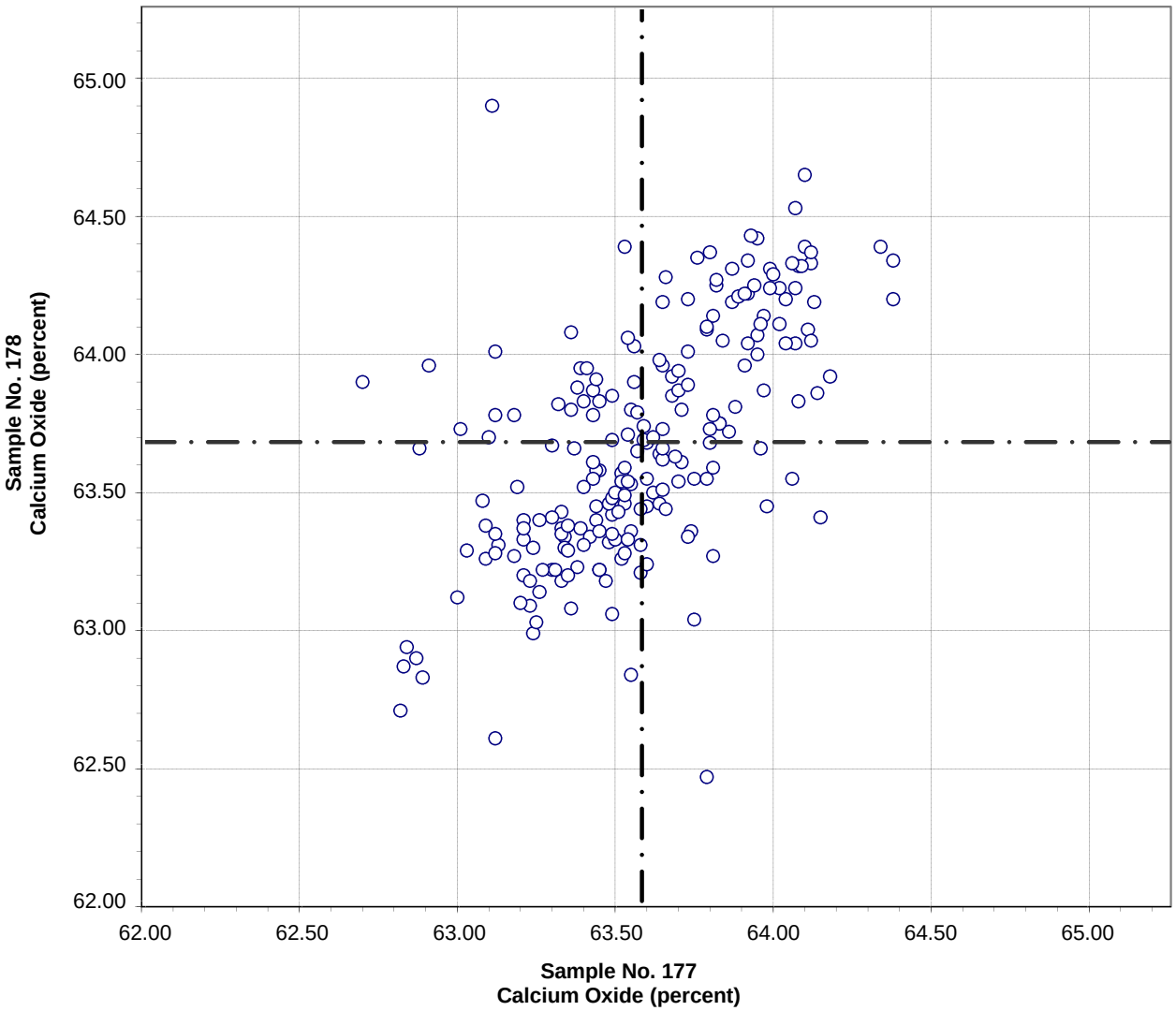


Test No. 30 Ferric Oxide 213 Points

Sample No. 177	Ave	2.87	S.D.	0.04	C.V.	1.4
Sample No. 178	Ave	3.09	S.D.	0.05	C.V.	1.5

Labs eliminated: 26, 407, 2464, 95, 206, 289, 502, 696, 736, 2491, 3454

CCRL Proficiency Sample Program
Calcium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

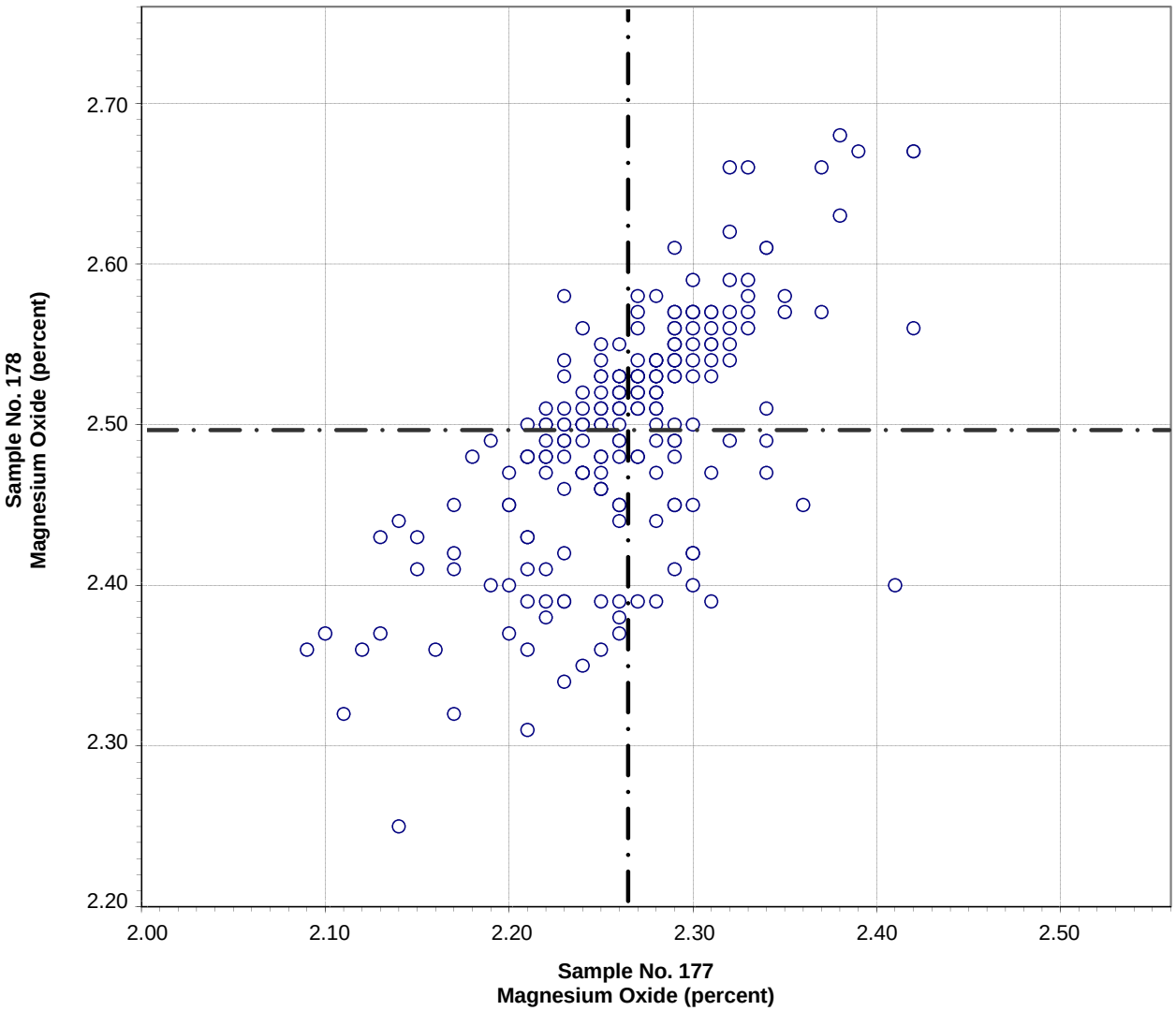


Test No. 40 Calcium Oxide 213 Points

Sample No. 177	Ave	63.58	S.D.	0.33	C.V.	0.5
Sample No. 178	Ave	63.68	S.D.	0.43	C.V.	0.7

Labs eliminated: 23, 50, 407, 2621, 289, 2464, 3059, 3428, 3454

CCRL Proficiency Sample Program
Magnesium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

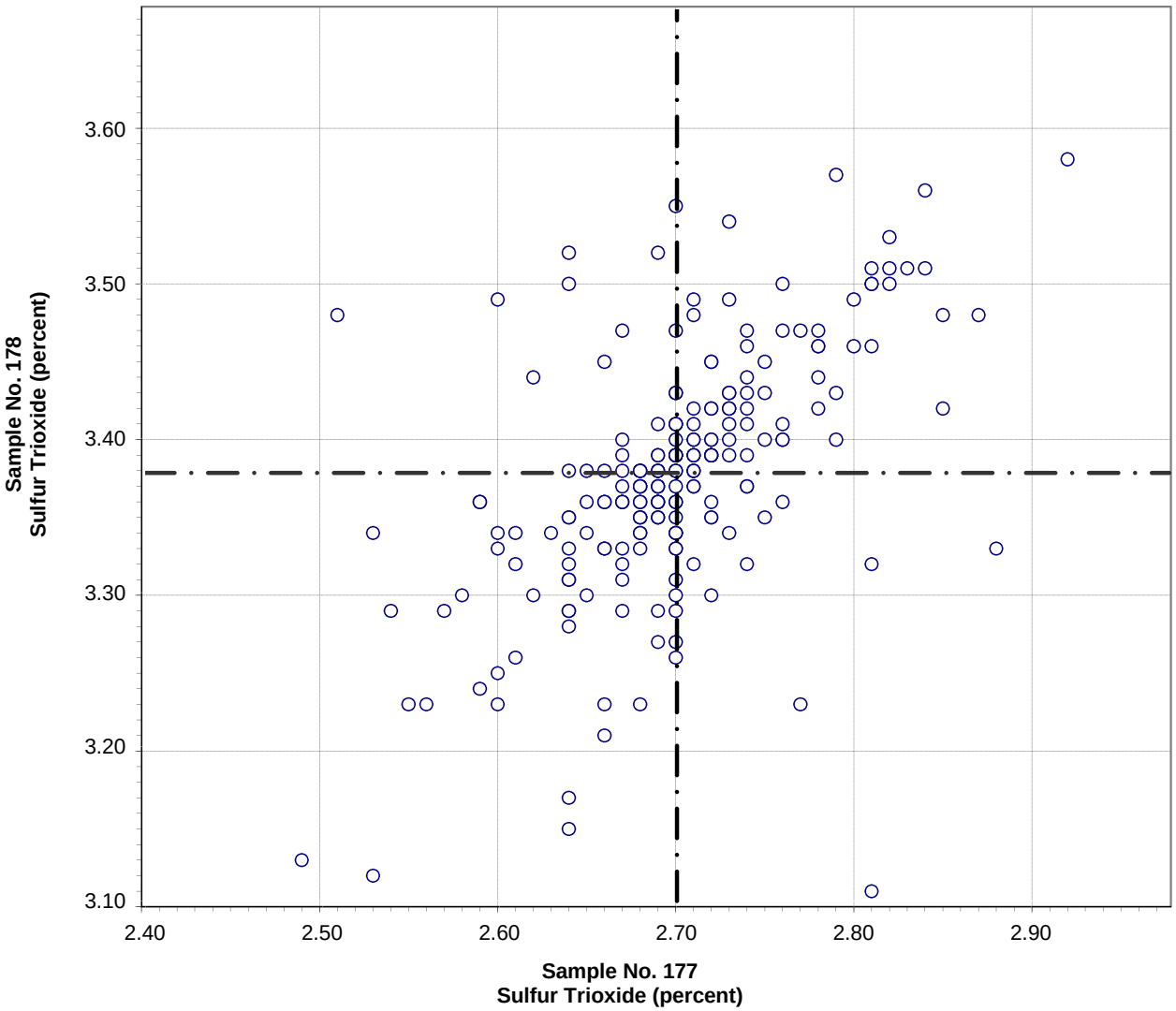


Test No. 50 Magnesium Oxide 211 Points

Sample No. 177	Ave	2.26	S.D.	0.06	C.V.	2.5
Sample No. 178	Ave	2.50	S.D.	0.07	C.V.	3.0

Labs eliminated: 53, 289, 407, 416, 95, 206, 696, 1594, 1644, 2463, 2466, 3454

CCRL Proficiency Sample Program
Sulfur Trioxide
PORTLAND CEMENT Samples No. 177 and No. 178

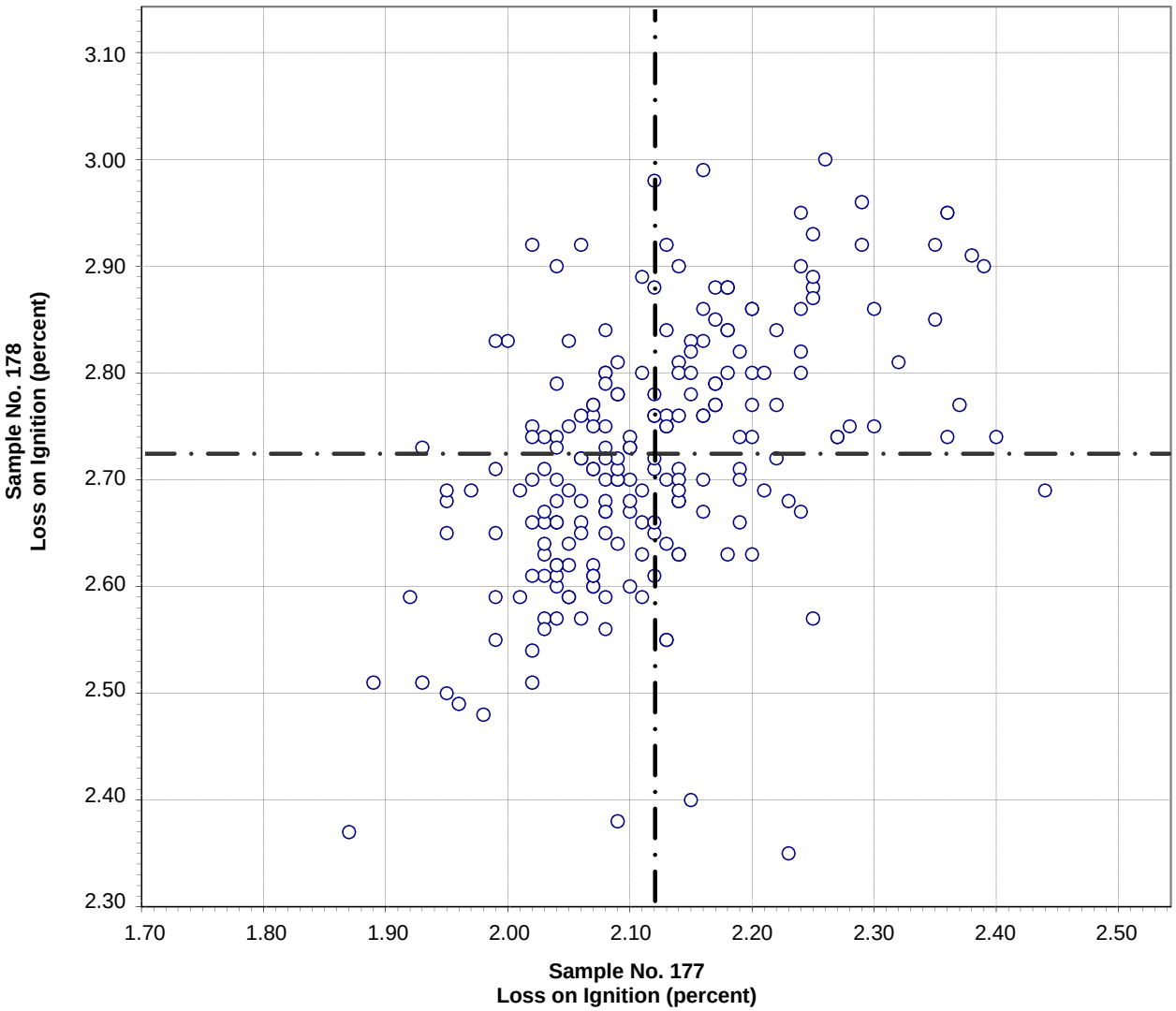


Test No. 60 Sulfur Trioxide 213 Points

Sample No. 177	Ave	2.70	S.D.	0.07	C.V.	2.5
Sample No. 178	Ave	3.38	S.D.	0.08	C.V.	2.4

Labs eliminated: 51, 53, 407, 696, 4, 40, 156, 416, 501, 1956, 2305, 2483, 3279, 3454

CCRL Proficiency Sample Program
Loss on Ignition
PORTLAND CEMENT Samples No. 177 and No. 178

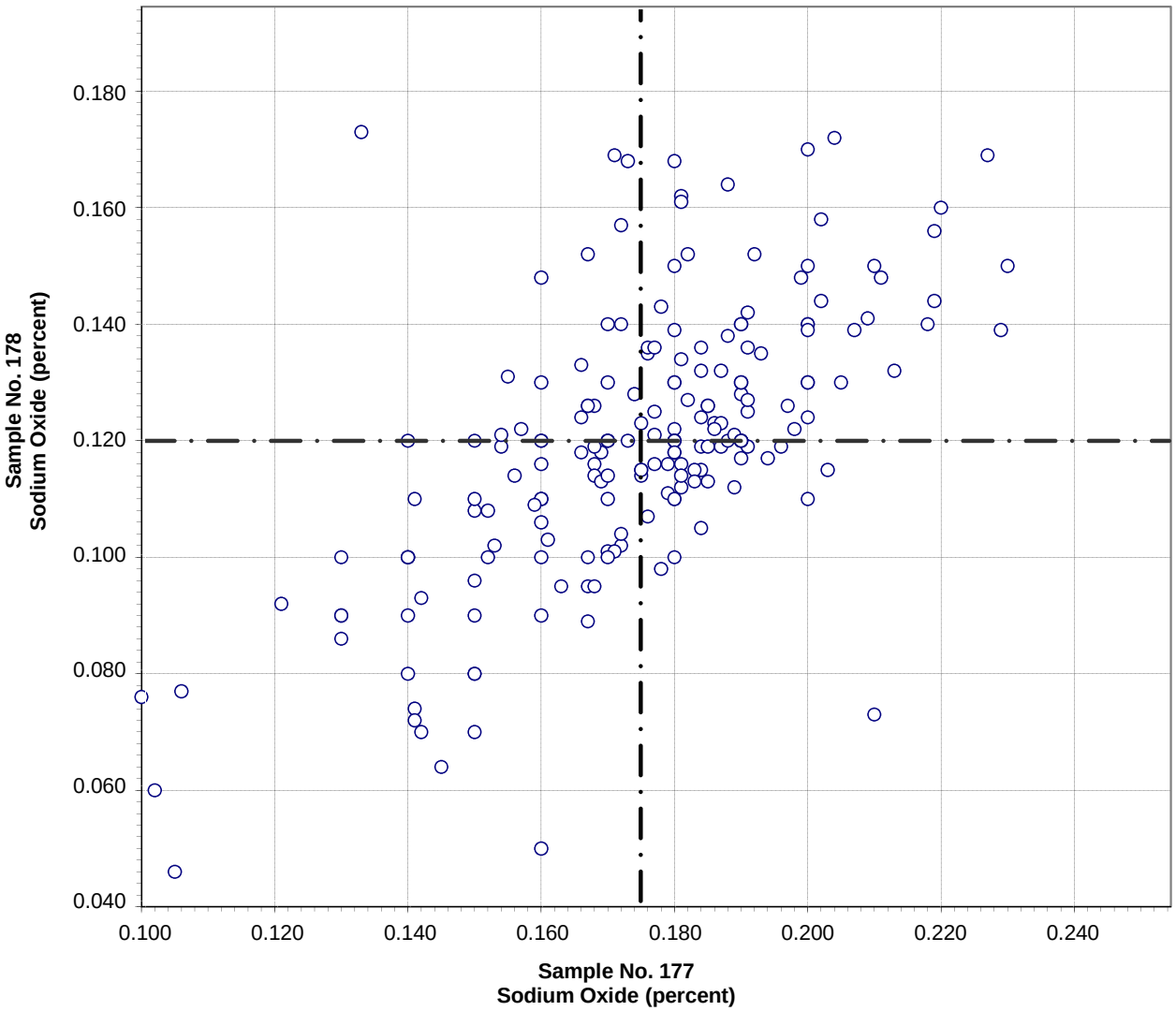


Test No. 70 Loss on Ignition 214 Points

Sample No. 177 Ave 2.12 S.D. 0.10 C.V. 4.8
Sample No. 178 Ave 2.72 S.D. 0.12 C.V. 4.3

Labs eliminated: 51, 90, 203, 1644, 2491, 2763, 206, 221, 431, 1466, 3059, 3415

CCRL Proficiency Sample Program
Sodium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

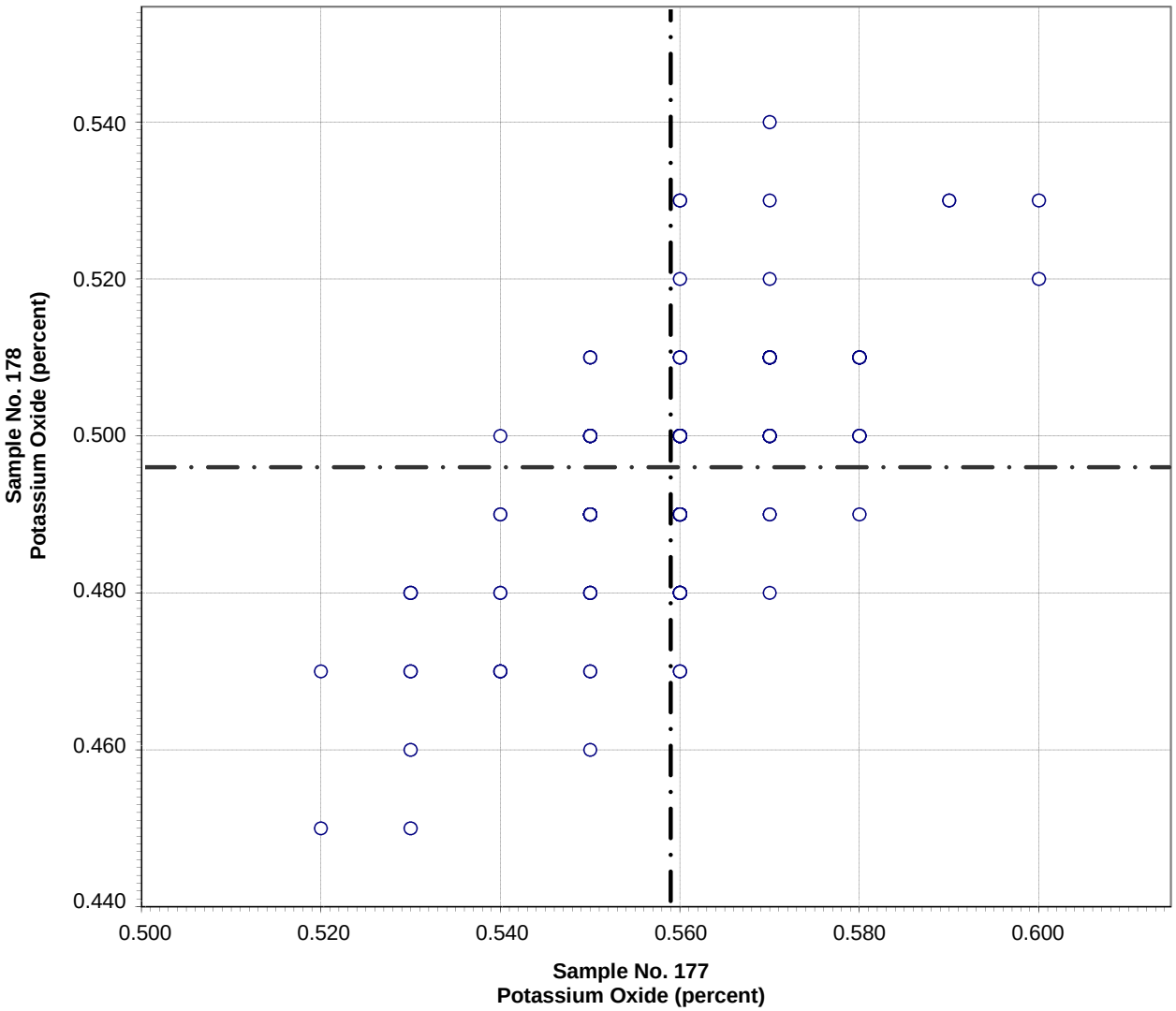


Test No. 90 Sodium Oxide 198 Points

Sample No. 177	Ave	0.175	S.D.	0.023	C.V.	13.2
Sample No. 178	Ave	0.120	S.D.	0.023	C.V.	19.3

Labs eliminated: 53, 78, 98, 110, 125, 1053, 1251, 4, 458, 696, 1956, 2463, 2464, 3057, 3238

CCRL Proficiency Sample Program
Potassium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

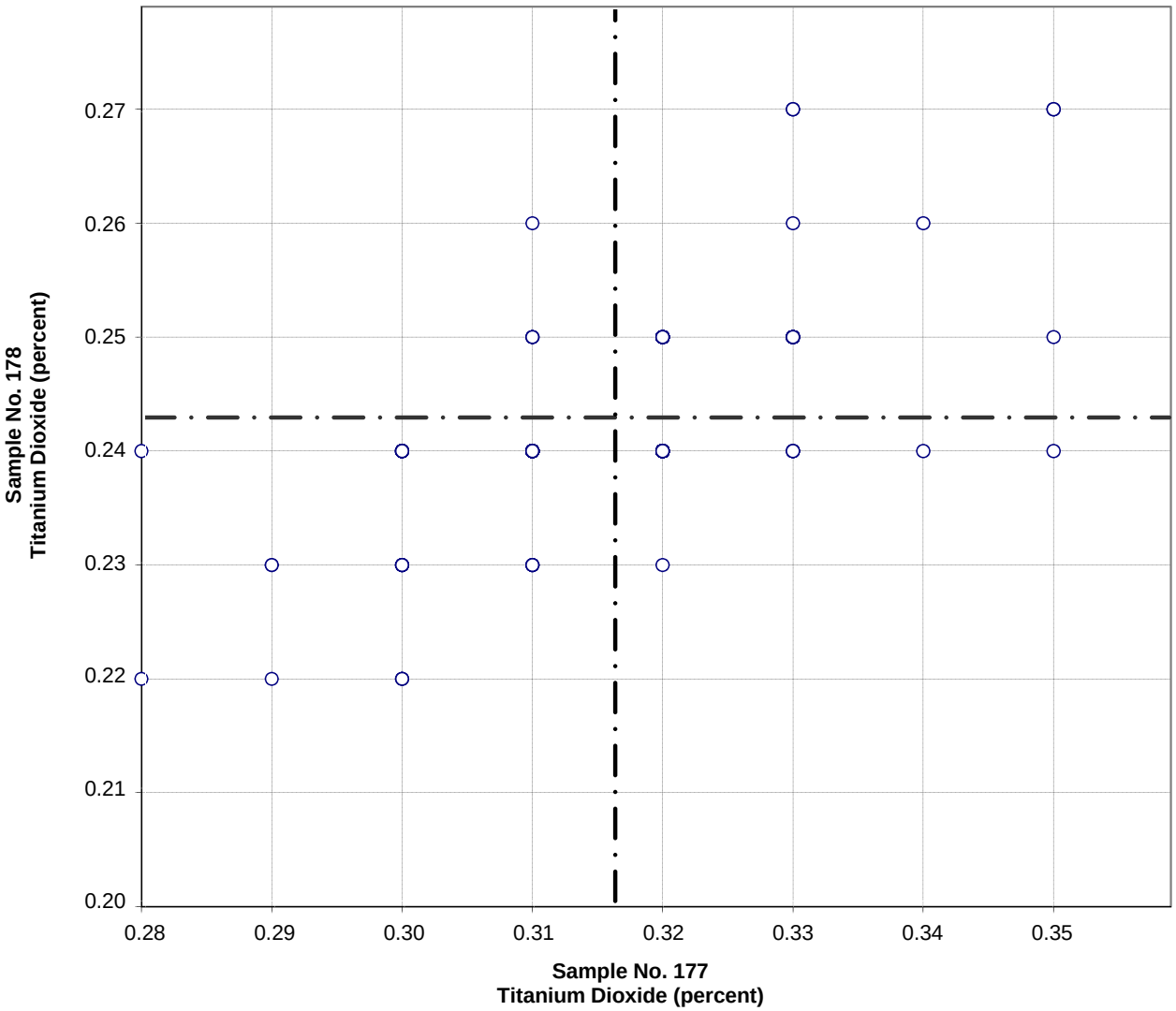


Test No. 100 Potassium Oxide 201 Points

Sample No. 177	Ave	0.559	S.D.	0.013	C.V.	2.2
Sample No. 178	Ave	0.496	S.D.	0.014	C.V.	2.8

Labs eliminated: 36, 158, 178, 407, 416, 2463, 3233, 3415, 1, 107, 206, 696, 768, 1190, 2253, 3057, 3454

CCRL Proficiency Sample Program
Titanium Dioxide
PORTLAND CEMENT Samples No. 177 and No. 178

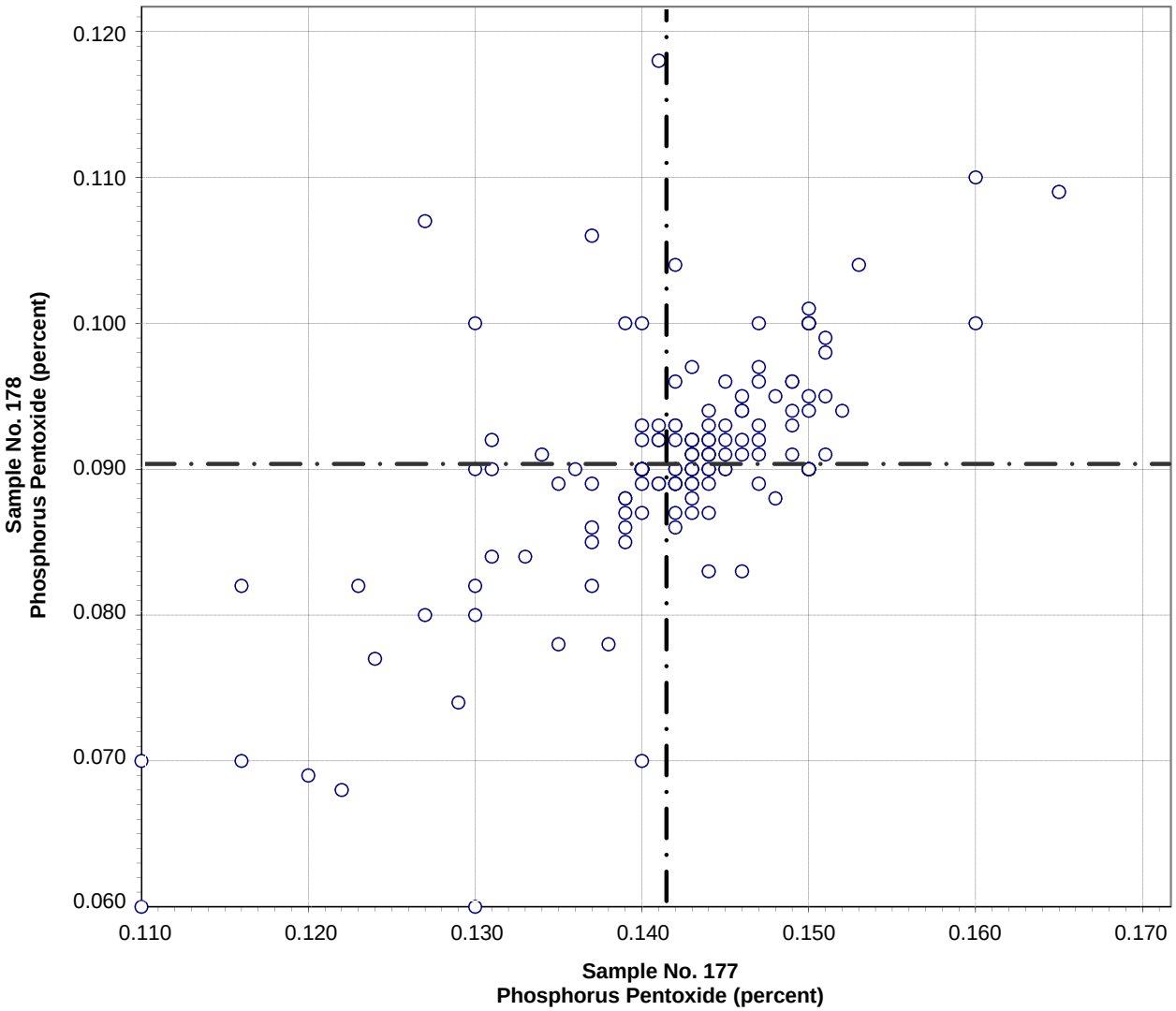


Test No. 103 Titanium Dioxide 171 Points

Sample No. 177 Ave 0.32 S.D. 0.012 C.V. 3.7
Sample No. 178 Ave 0.24 S.D. 0.009 C.V. 3.5

Labs eliminated: 84, 107, 53, 407, 696, 768, 2491

CCRL Proficiency Sample Program
Phosphorus Pentoxide
PORTLAND CEMENT Samples No. 177 and No. 178

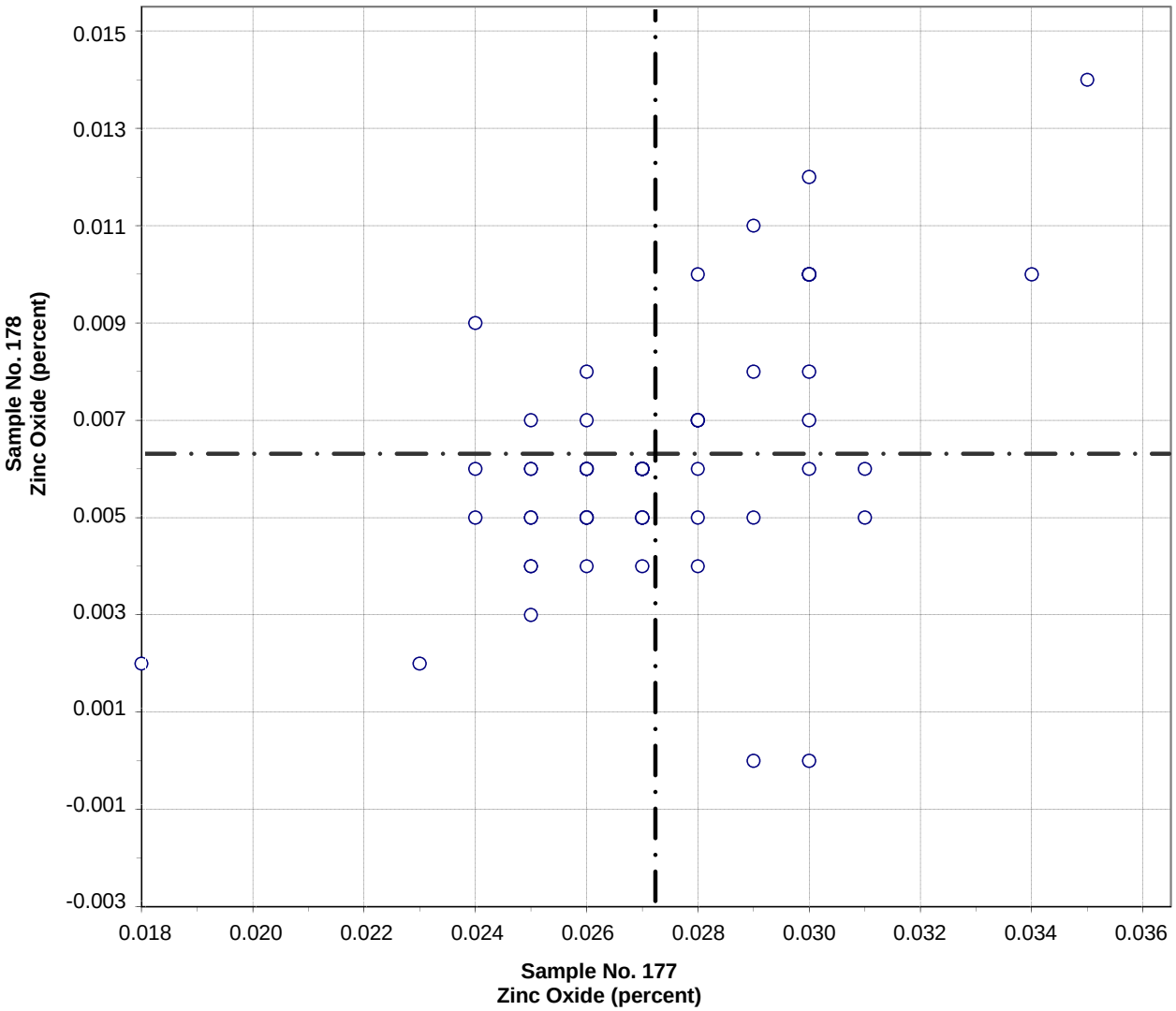


Test No. 102 Phosphorus Pentoxide 163 Points

Sample No. 177	Ave	0.141	S.D.	0.008	C.V.	5.7
Sample No. 178	Ave	0.090	S.D.	0.008	C.V.	8.6

Labs eliminated: 92, 98, 1799, 2116, 4, 53, 107, 139, 696, 2463, 2484, 3291

CCRL Proficiency Sample Program
Zinc Oxide
PORTLAND CEMENT Samples No. 177 and No. 178



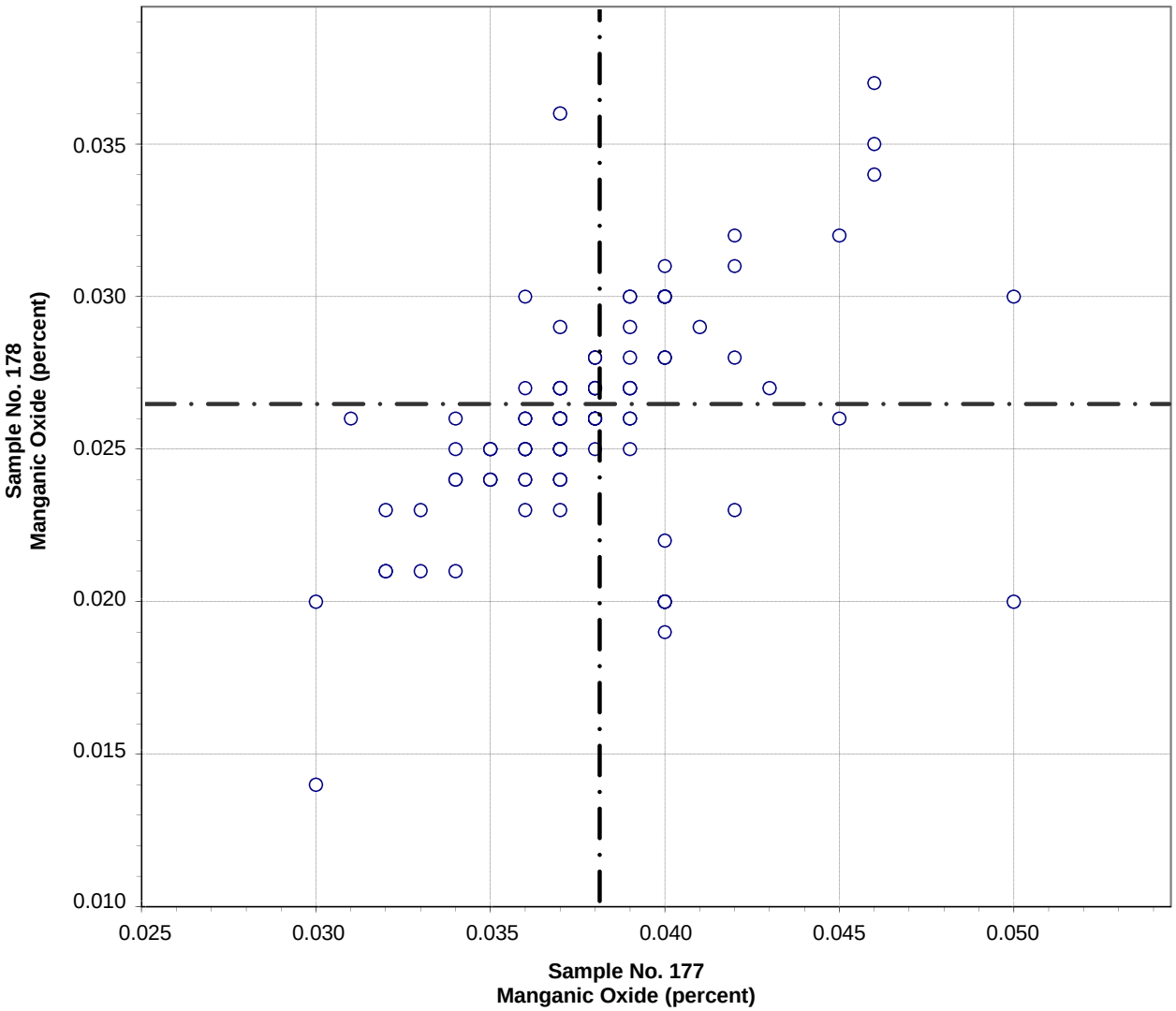
Test No. 99 Zinc Oxide 73 Points

Sample No. 177	Ave	0.027	S.D.	0.003	C.V.	10.1
Sample No. 178	Ave	0.006	S.D.	0.003	C.V.	41.3

Labs eliminated: 74, 95, 206, 408, 696, 1466, 2934

Labs off Diagram: 493

CCRL Proficiency Sample Program
Manganic Oxide
PORTLAND CEMENT Samples No. 177 and No. 178



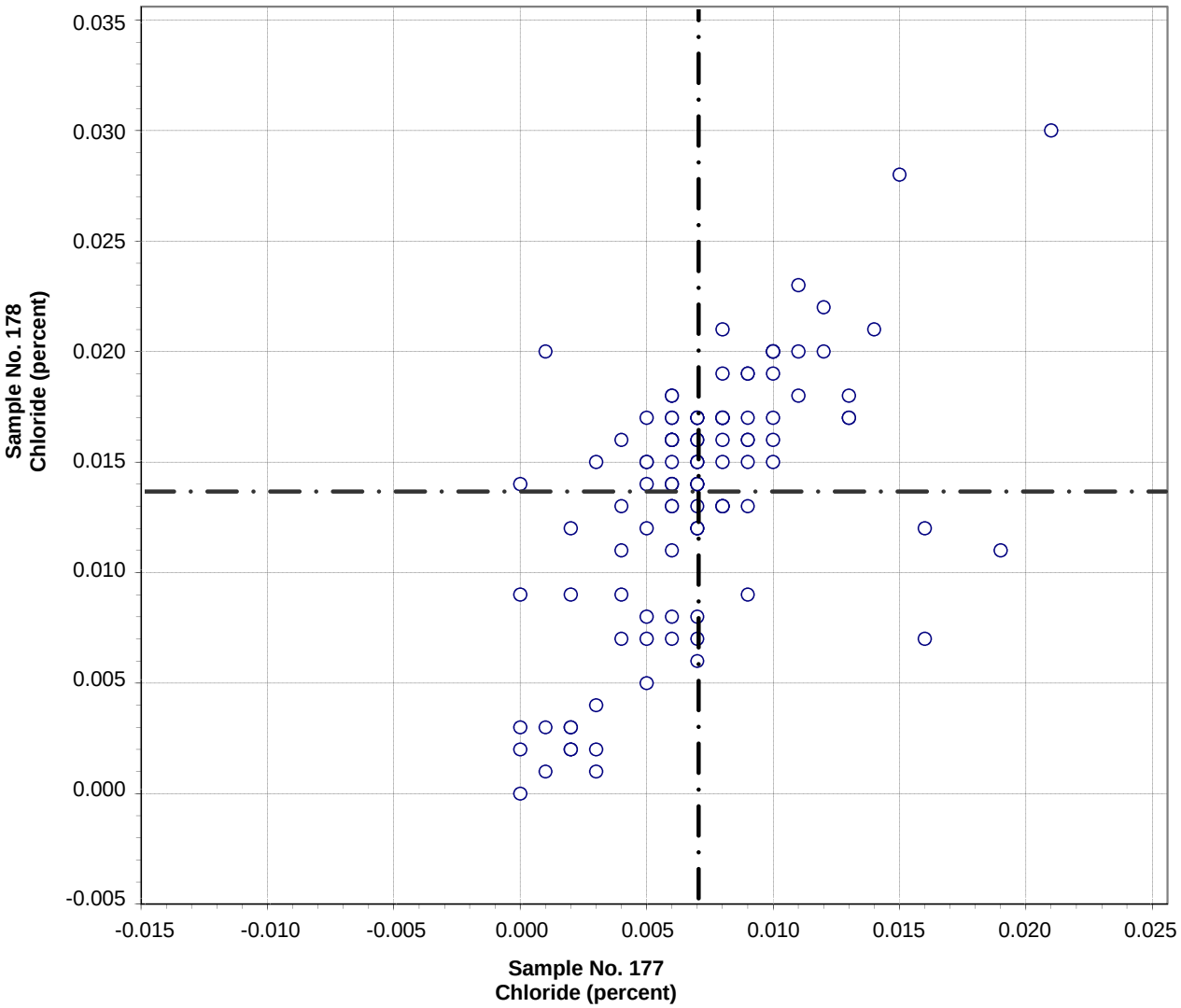
Test No. 101 Manganic Oxide 125 Points

Sample No. 177	Ave	0.038	S.D.	0.004	C.V.	9.2
Sample No. 178	Ave	0.026	S.D.	0.004	C.V.	14.8

Labs eliminated: 162, 181, 354, 407, 692, 2463

Labs off Diagram: 107, 209

CCRL Proficiency Sample Program
Chloride
PORTLAND CEMENT Samples No. 177 and No. 178

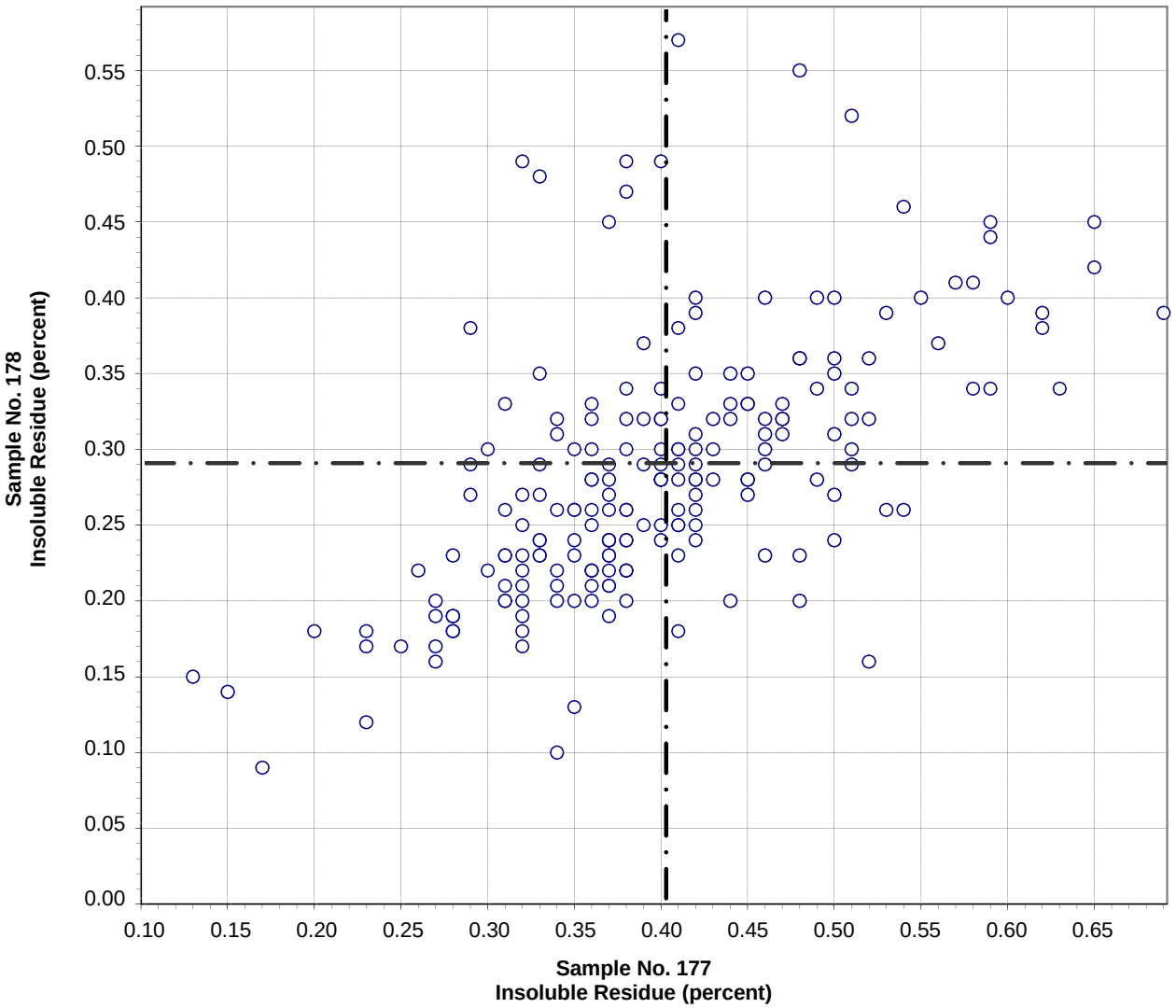


Test No. 104 Chloride 109 Points

Sample No. 177	Ave	0.007	S.D.	0.004	C.V.	54.7
Sample No. 178	Ave	0.014	S.D.	0.006	C.V.	42.7

Labs eliminated: 181, 206, 457, 3428

CCRL Proficiency Sample Program
Insoluble Residue
PORTLAND CEMENT Samples No. 177 and No. 178



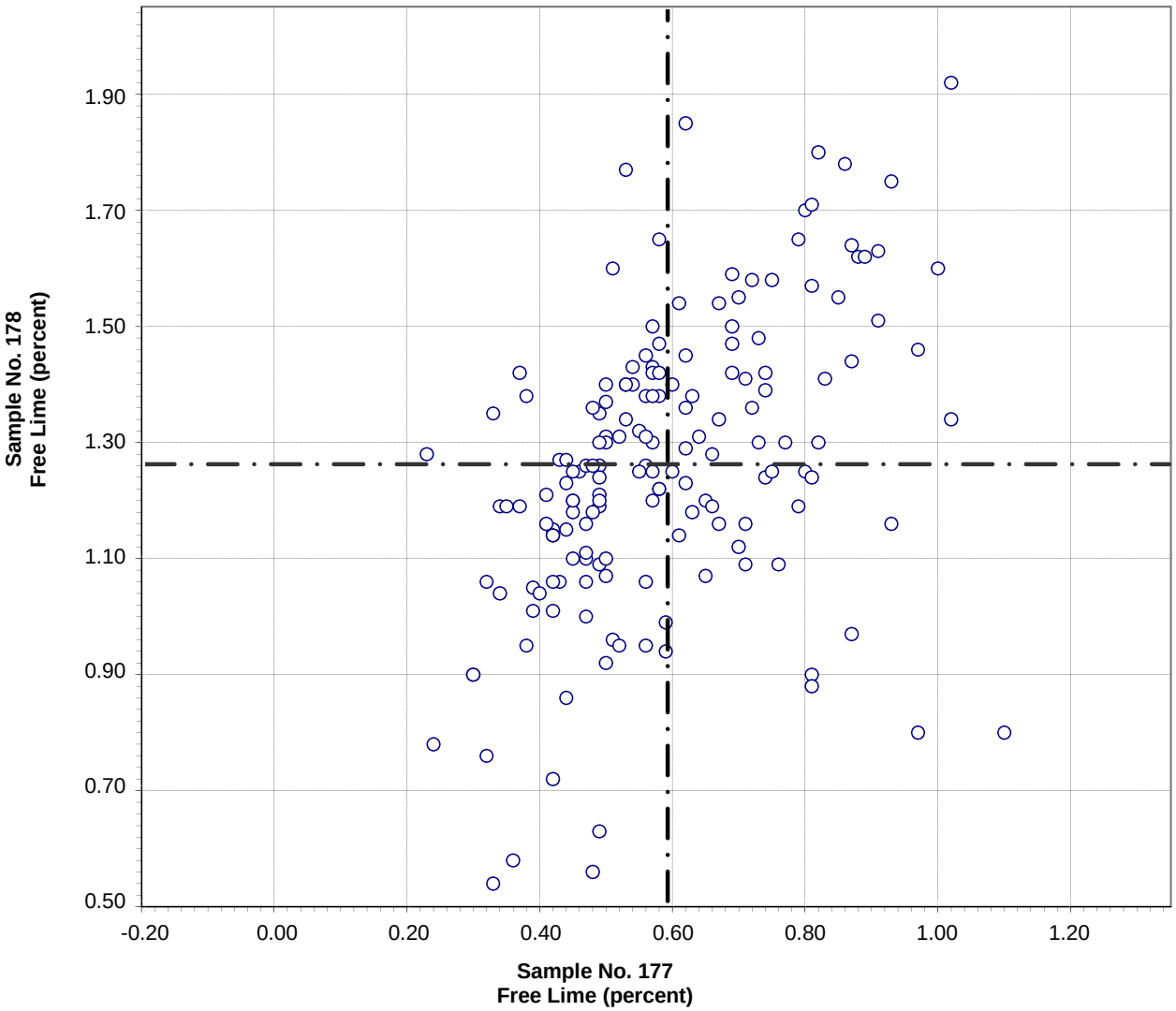
Test No. 80 Insoluble Residue 205 Points

Sample No. 177	Ave	0.40	S.D.	0.10	C.V.	23.8
Sample No. 178	Ave	0.29	S.D.	0.09	C.V.	32.1

Labs eliminated: 206, 605, 3415, 3454

Labs off Diagram: 1025, 3233, 3235

CCRL Proficiency Sample Program
Free Lime
PORTLAND CEMENT Samples No. 177 and No. 178

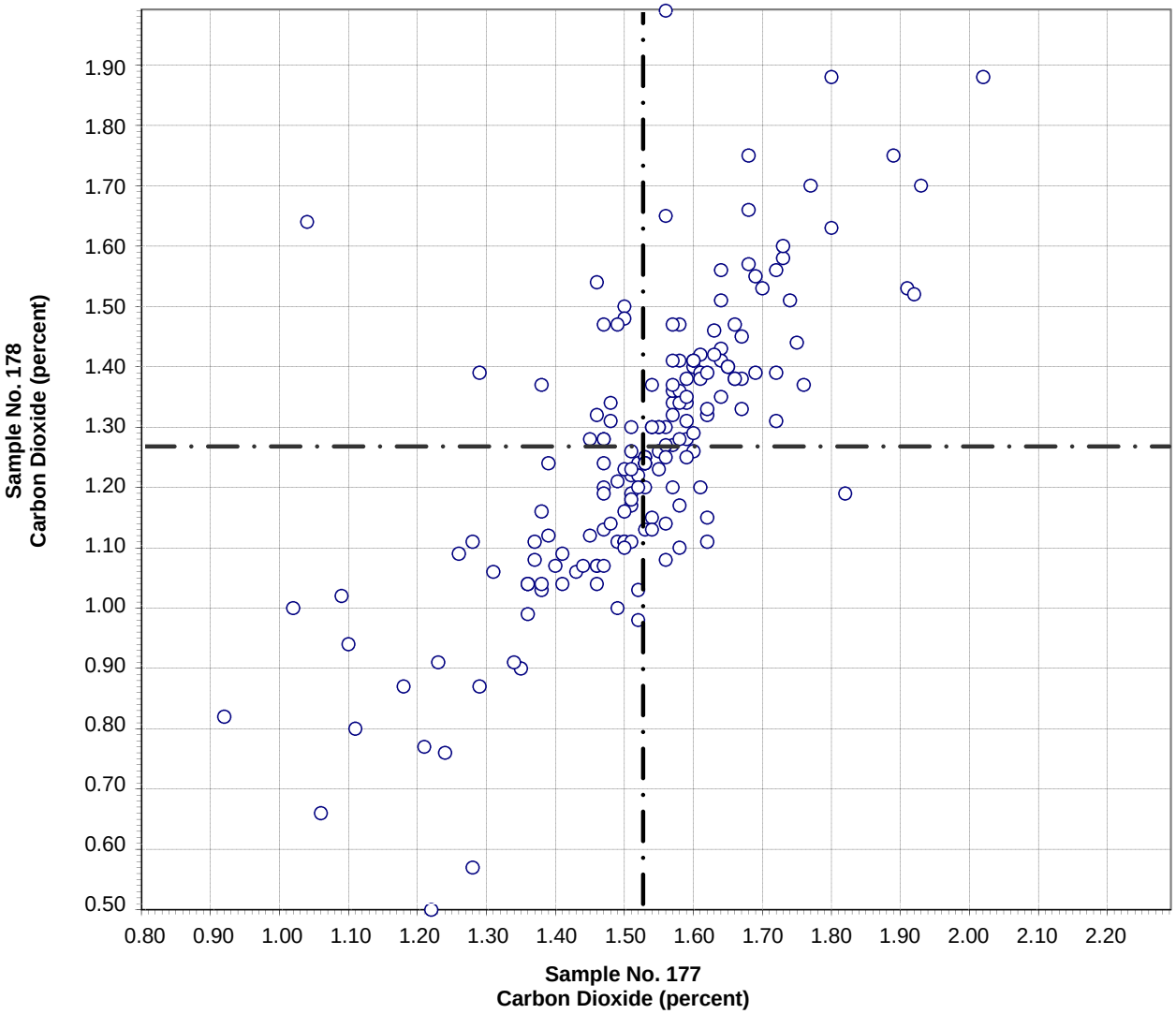


Test No. 41 Free Lime 166 Points

Sample No. 177	Ave	0.59	S.D.	0.18	C.V.	29.8
Sample No. 178	Ave	1.26	S.D.	0.25	C.V.	20.1

Labs eliminated: 284, 494, 2363, 2490, 3235

CCRL Proficiency Sample Program
Carbon Dioxide
PORTLAND CEMENT Samples No. 177 and No. 178

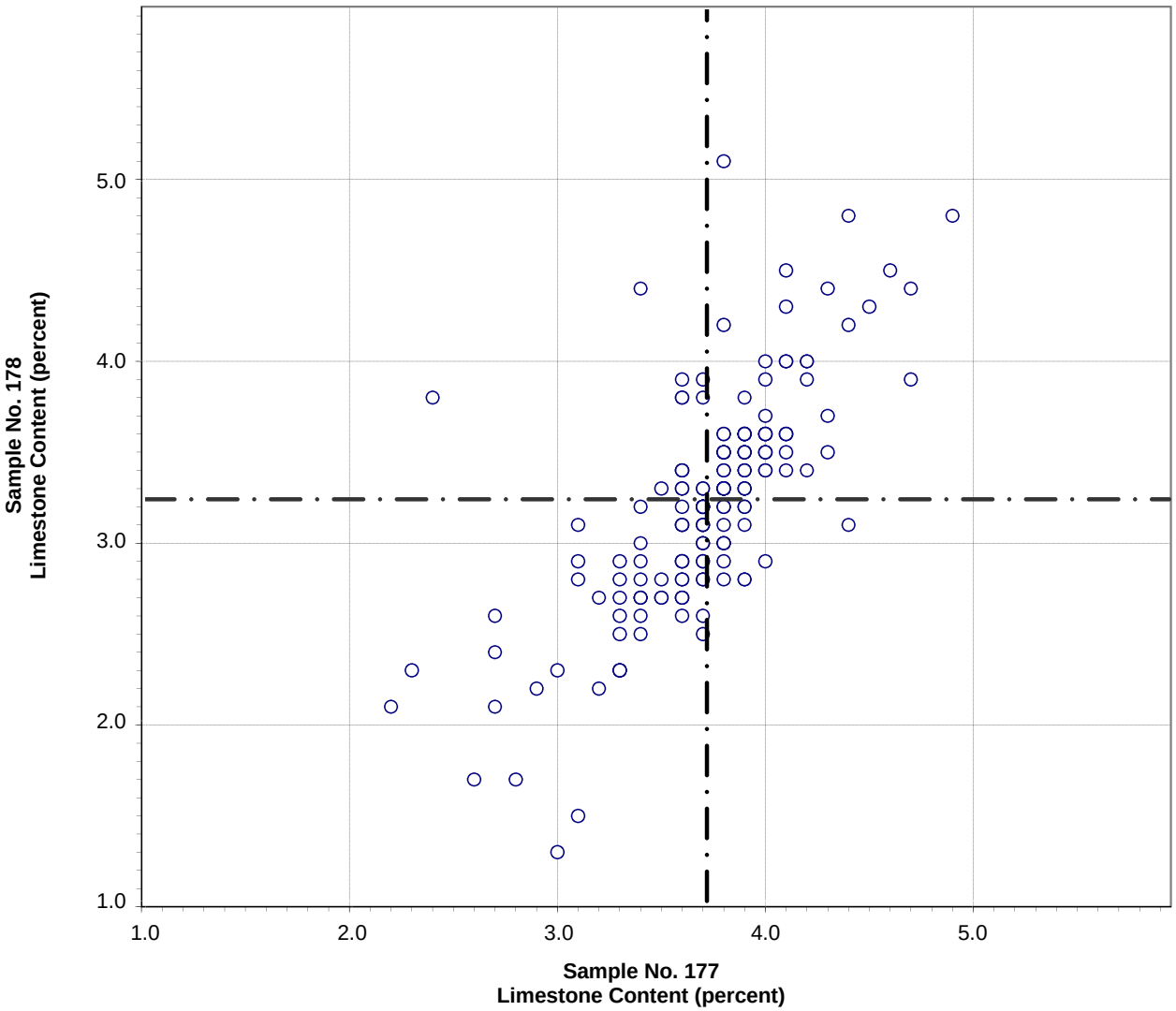


Test No. 97 Carbon Dioxide 175 Points

Sample No. 177	Ave	1.53	S.D.	0.17	C.V.	11.1
Sample No. 178	Ave	1.27	S.D.	0.23	C.V.	18.3

Labs eliminated: 56, 66, 162, 975, 2466

CCRL Proficiency Sample Program
Limestone Content
PORTLAND CEMENT Samples No. 177 and No. 178

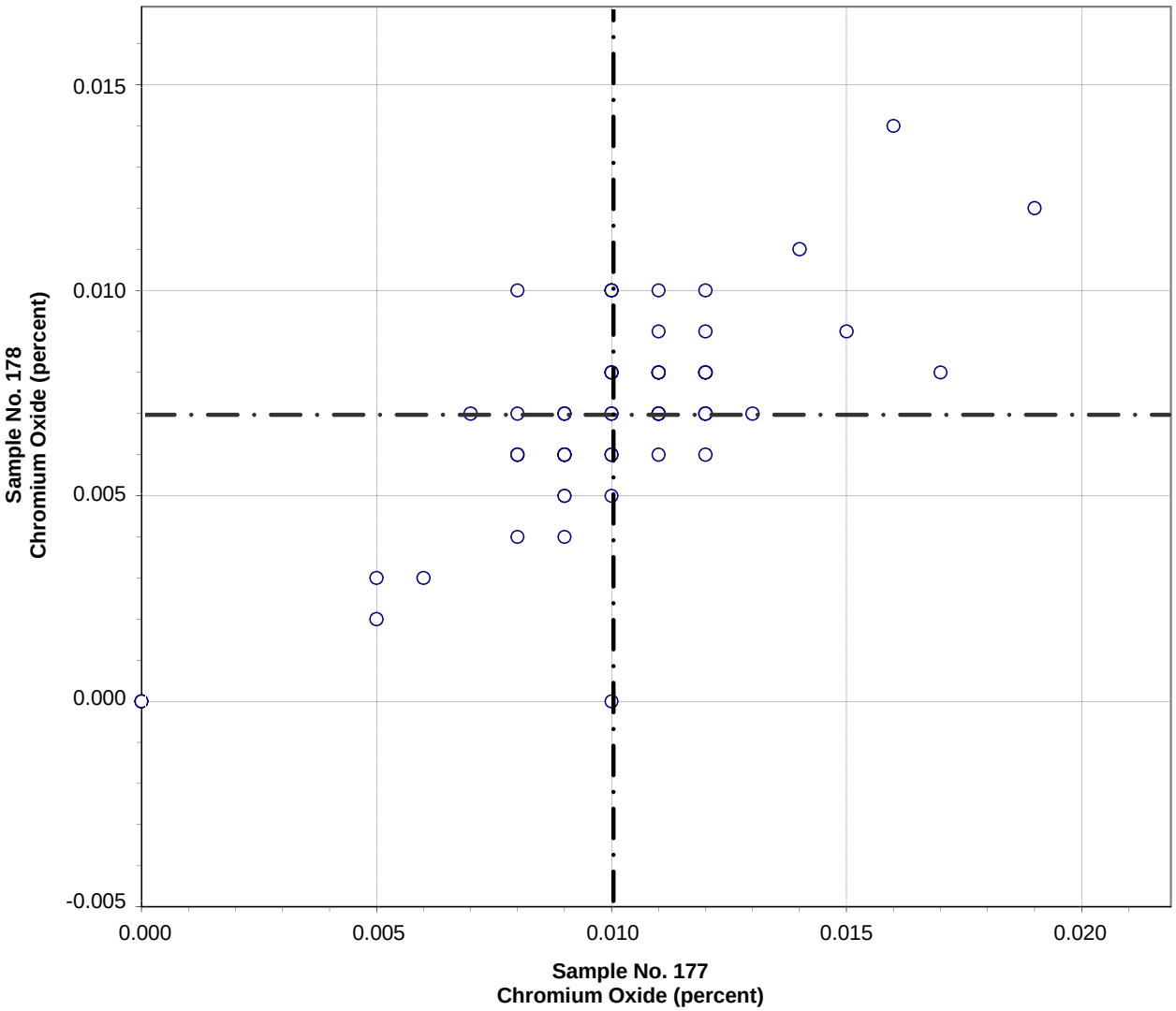


Test No. 98 Limestone Content 171 Points

Sample No. 177	Ave	3.7	S.D.	0.4	C.V.	11.4
Sample No. 178	Ave	3.2	S.D.	0.6	C.V.	18.8

Labs eliminated: 56, 66, 162, 975, 2466, 2477

CCRL Proficiency Sample Program
Chromium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

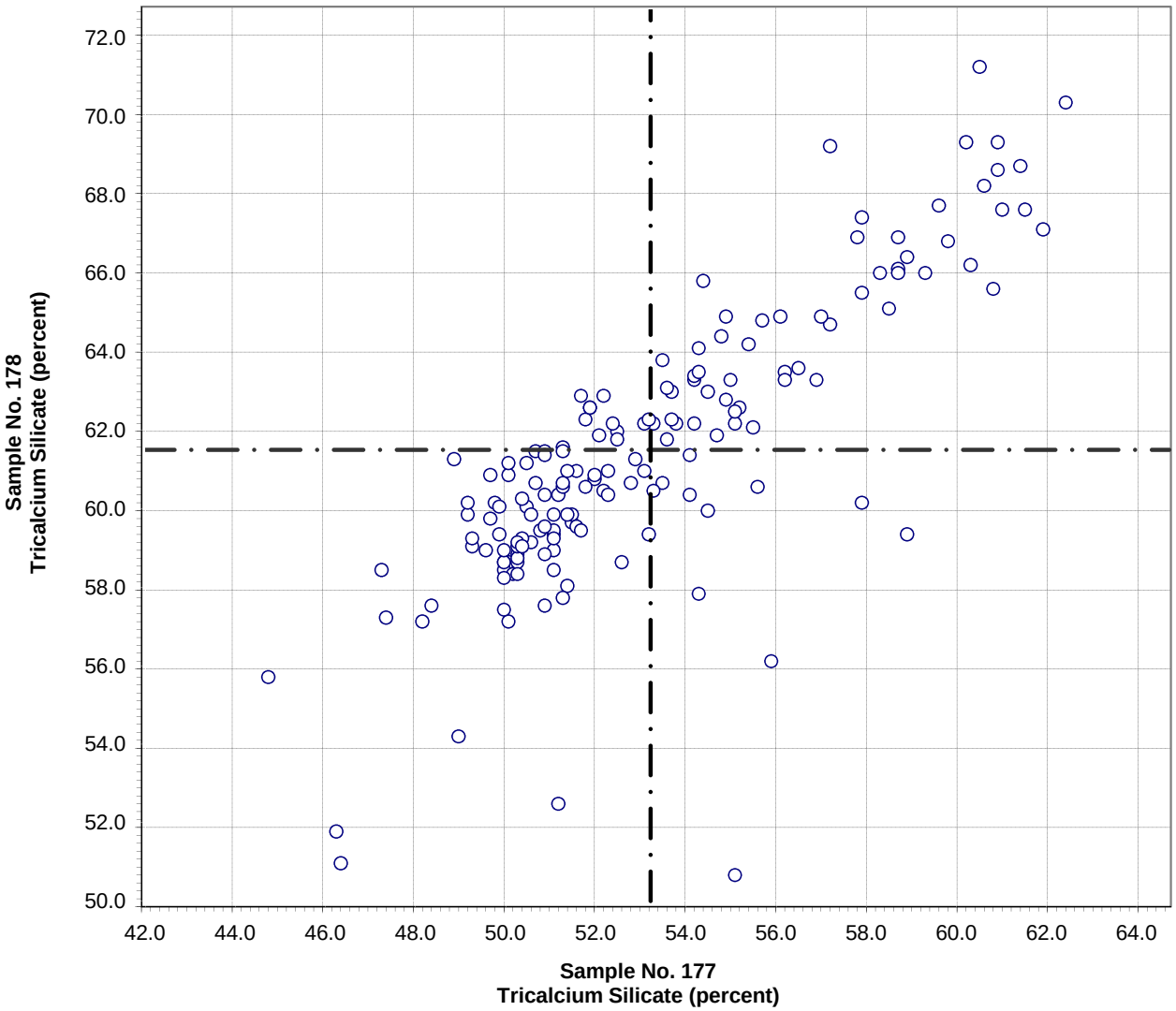


Test No. 105 Chromium Oxide 75 Points

Sample No. 177	Ave	0.010	S.D.	0.003	C.V.	30.4
Sample No. 178	Ave	0.007	S.D.	0.003	C.V.	36.7

Labs eliminated: 415, 1956, 2462

CCRL Proficiency Sample Program
Tricalcium Silicate
PORTLAND CEMENT Samples No. 177 and No. 178

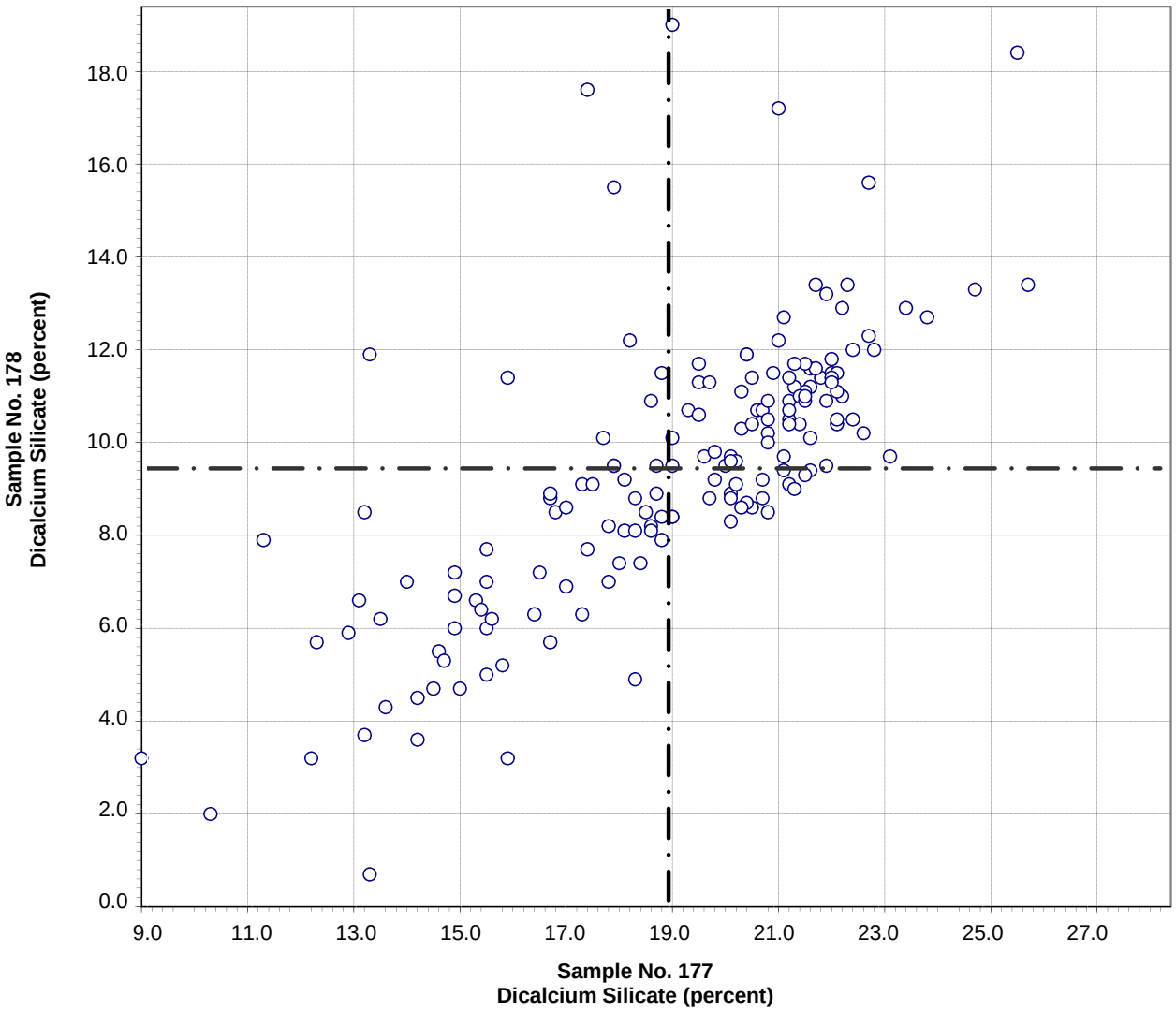


Test No. 106 Tricalcium Silicate 163 Points

Sample No. 177	Ave	53.2	S.D.	3.6	C.V. 6.8
Sample No. 178	Ave	61.5	S.D.	3.5	C.V. 5.7

Labs eliminated: 8, 407, 2463, 2477, 2621

CCRL Proficiency Sample Program
Dicalcium Silicate
PORTLAND CEMENT Samples No. 177 and No. 178

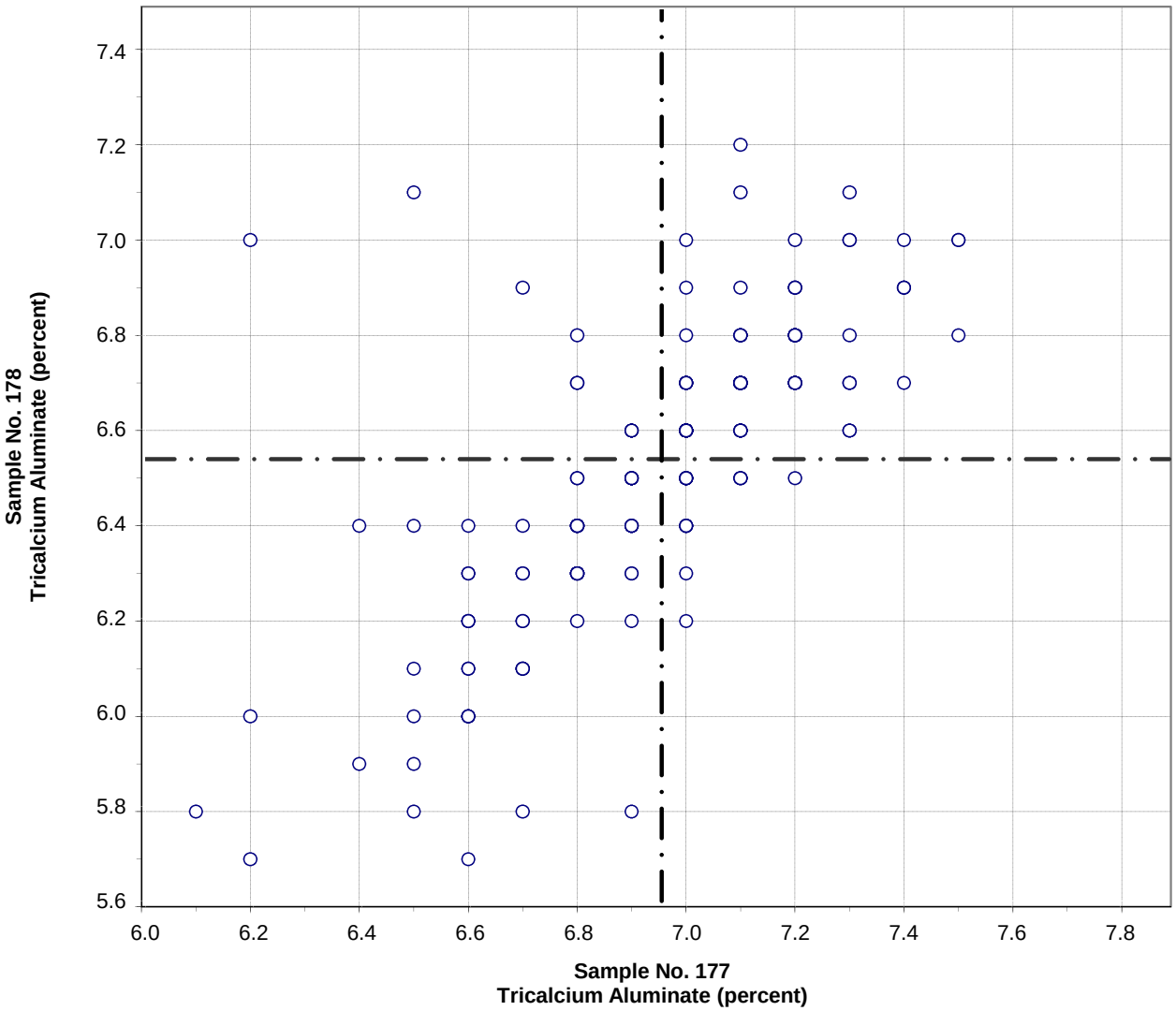


Test No. 107 Dicalcium Silicate 165 Points

Sample No. 177 Ave 19.0 S.D. 3.1 C.V. 16.4
Sample No. 178 Ave 9.4 S.D. 2.9 C.V. 31.2

Labs eliminated: 93, 2463, 2621

CCRL Proficiency Sample Program
Tricalcium Aluminate
PORTLAND CEMENT Samples No. 177 and No. 178

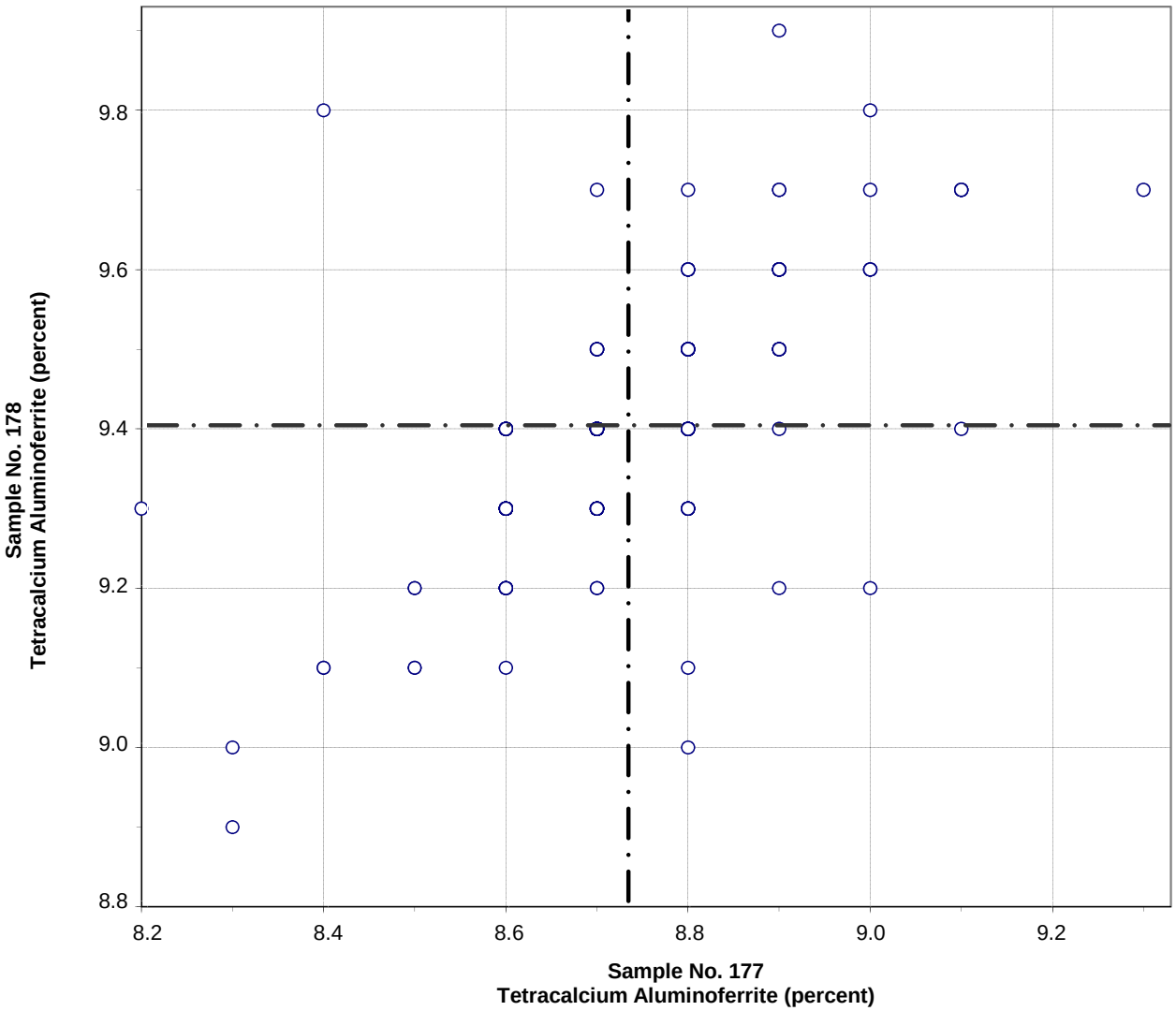


Test No. 108 Tricalcium Aluminate 186 Points

Sample No. 177	Ave	7.0	S.D.	0.3	C.V.	3.6
Sample No. 178	Ave	6.5	S.D.	0.3	C.V.	4.5

Labs eliminated: 124, 289, 2464, 2491, 38, 975, 2463, 3454

CCRL Proficiency Sample Program
Tetracalcium Aluminoferrite
PORTLAND CEMENT Samples No. 177 and No. 178



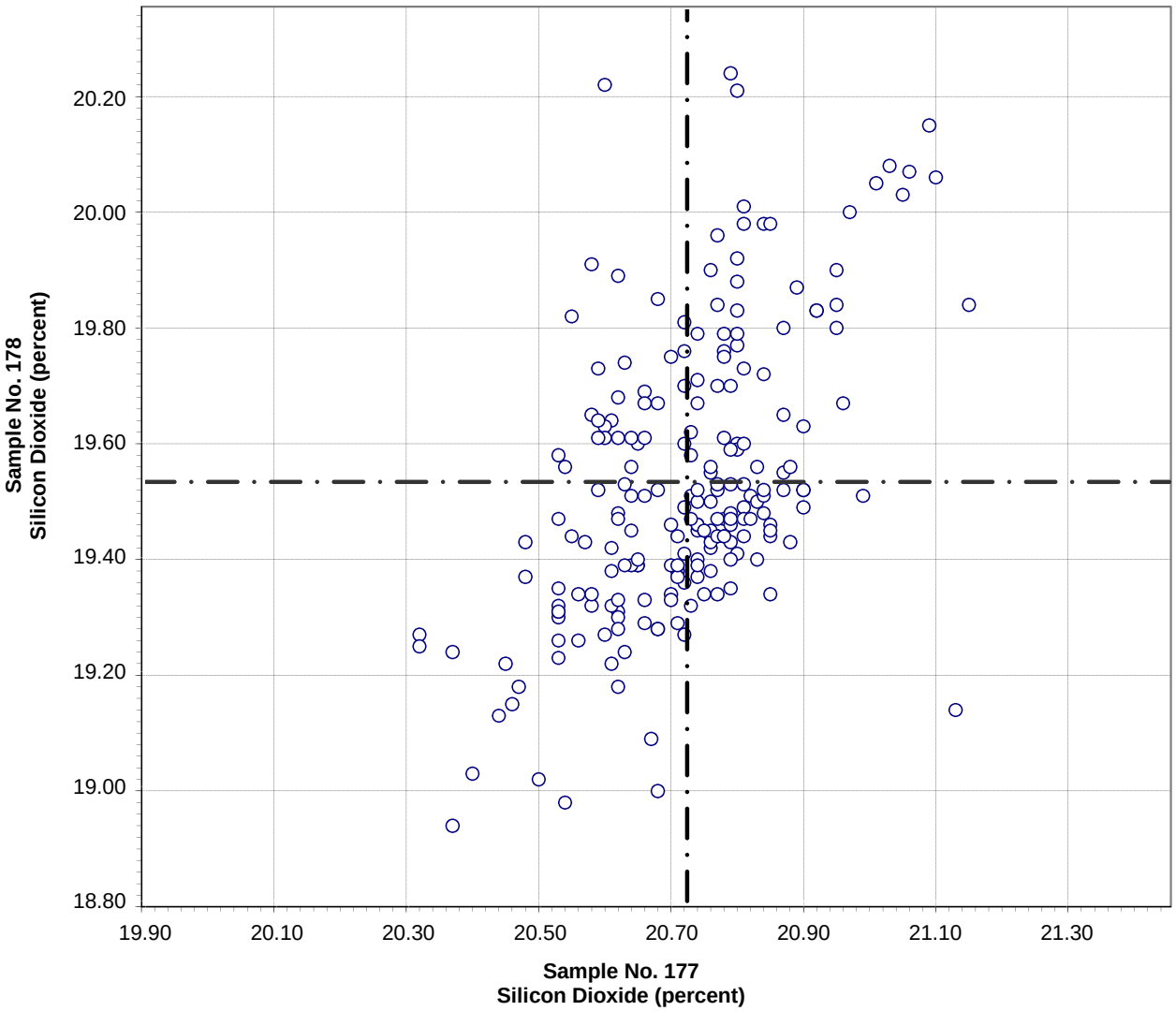
Test No. 109 Tetracalcium Aluminoferrite 179 Points

Sample No. 177 Ave 8.7 S.D. 0.2 C.V. 1.8
Sample No. 178 Ave 9.4 S.D. 0.2 C.V. 1.8

Labs eliminated: 66, 209, 124, 206, 289, 407, 504, 696, 2491, 3454

Labs off Diagram: 165, 502

CCRL Proficiency Sample Program
Silicon Dioxide
PORTLAND CEMENT Samples No. 177 and No. 178

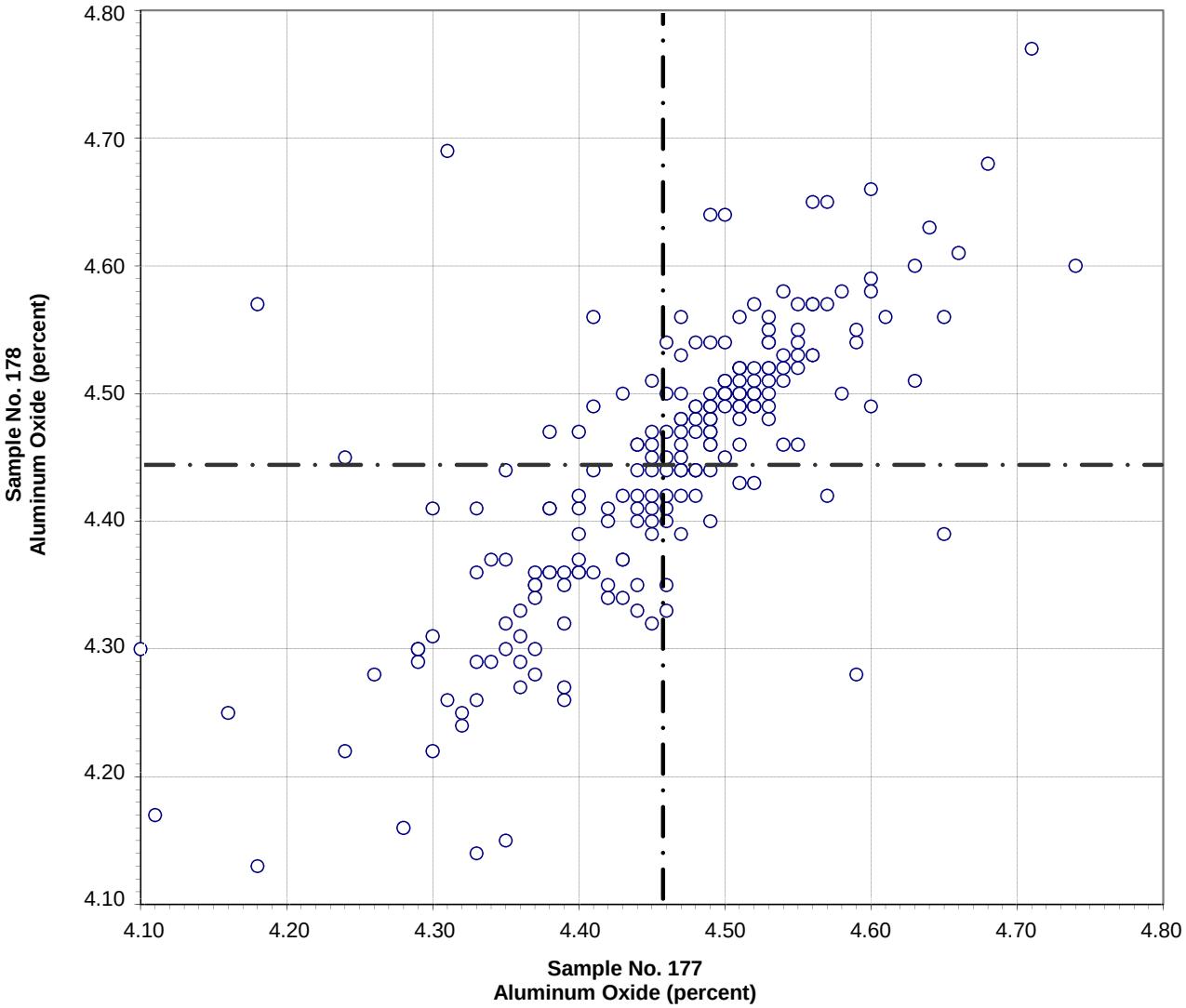


Test No. 10 Silicon Dioxide 213 Points

Sample No. 177	Ave	20.72	S.D.	0.14	C.V.	0.7
Sample No. 178	Ave	19.53	S.D.	0.24	C.V.	1.2

Labs eliminated: 4, 26, 51, 93, 289, 407, 696, 779, 28, 52, 768, 1594, 3059, 3428

CCRL Proficiency Sample Program
Aluminum Oxide
PORTLAND CEMENT Samples No. 177 and No. 178



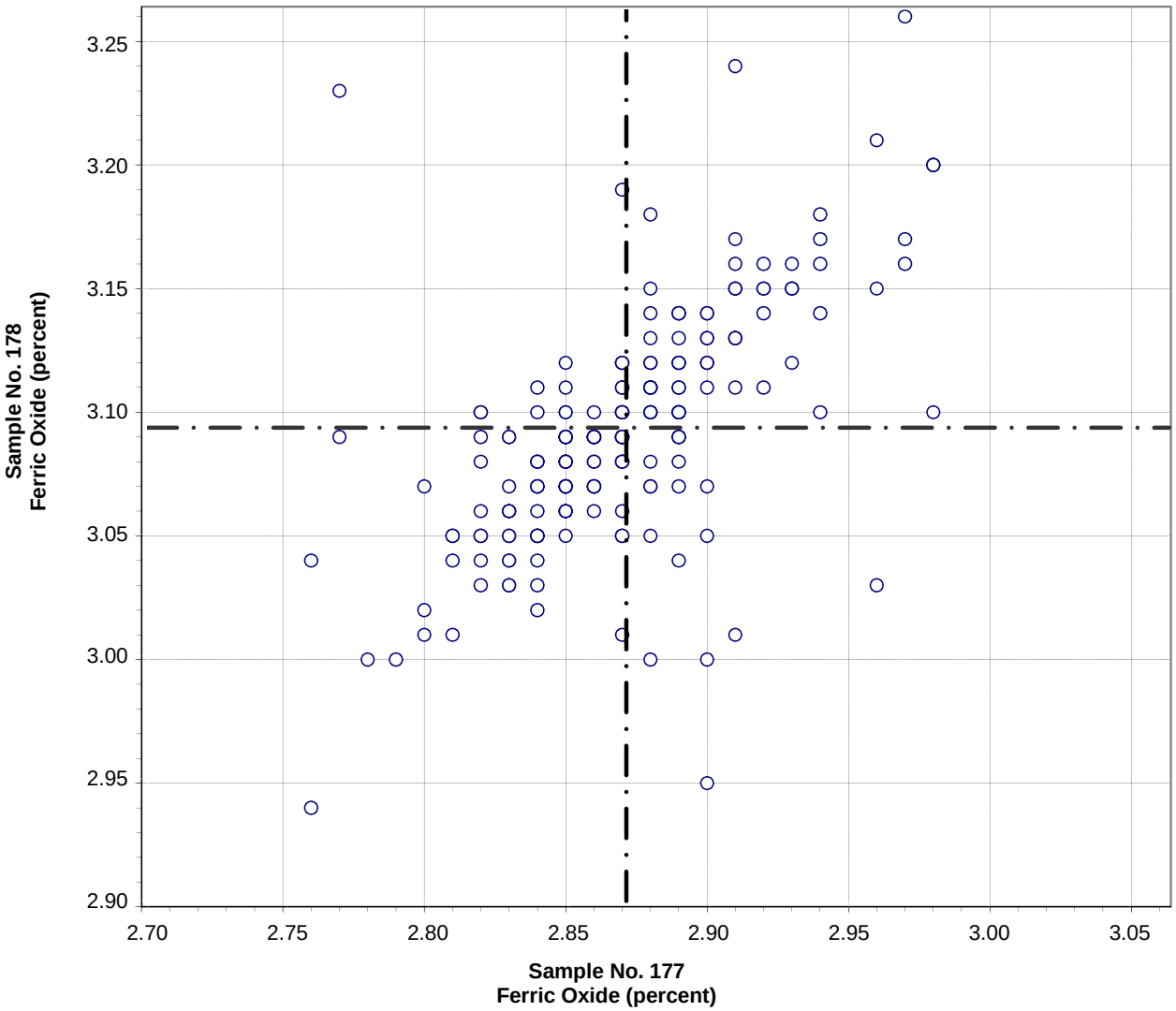
Test No. 21 Aluminum Oxide 215 Points

Sample No. 177	Ave	4.46	S.D.	0.10	C.V.	2.3
Sample No. 178	Ave	4.44	S.D.	0.11	C.V.	2.5

Labs eliminated: 26, 38, 52, 289, 407, 3454

Labs off Diagram: 2463

CCRL Proficiency Sample Program
Ferric Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

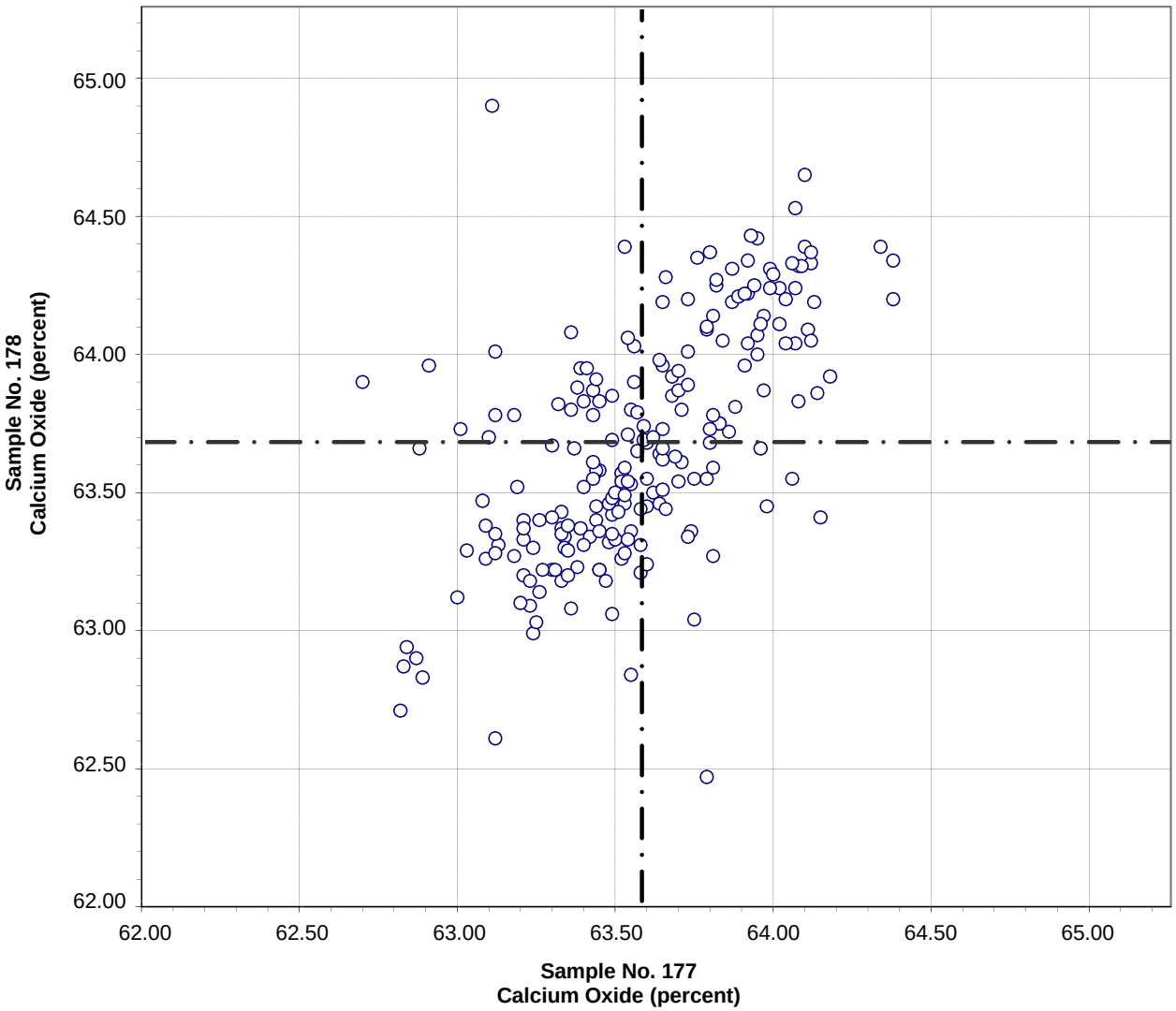


Test No. 30 Ferric Oxide 213 Points

Sample No. 177	Ave	2.87	S.D.	0.04	C.V.	1.4
Sample No. 178	Ave	3.09	S.D.	0.05	C.V.	1.5

Labs eliminated: 26, 407, 2464, 95, 206, 289, 502, 696, 736, 2491, 3454

CCRL Proficiency Sample Program
Calcium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

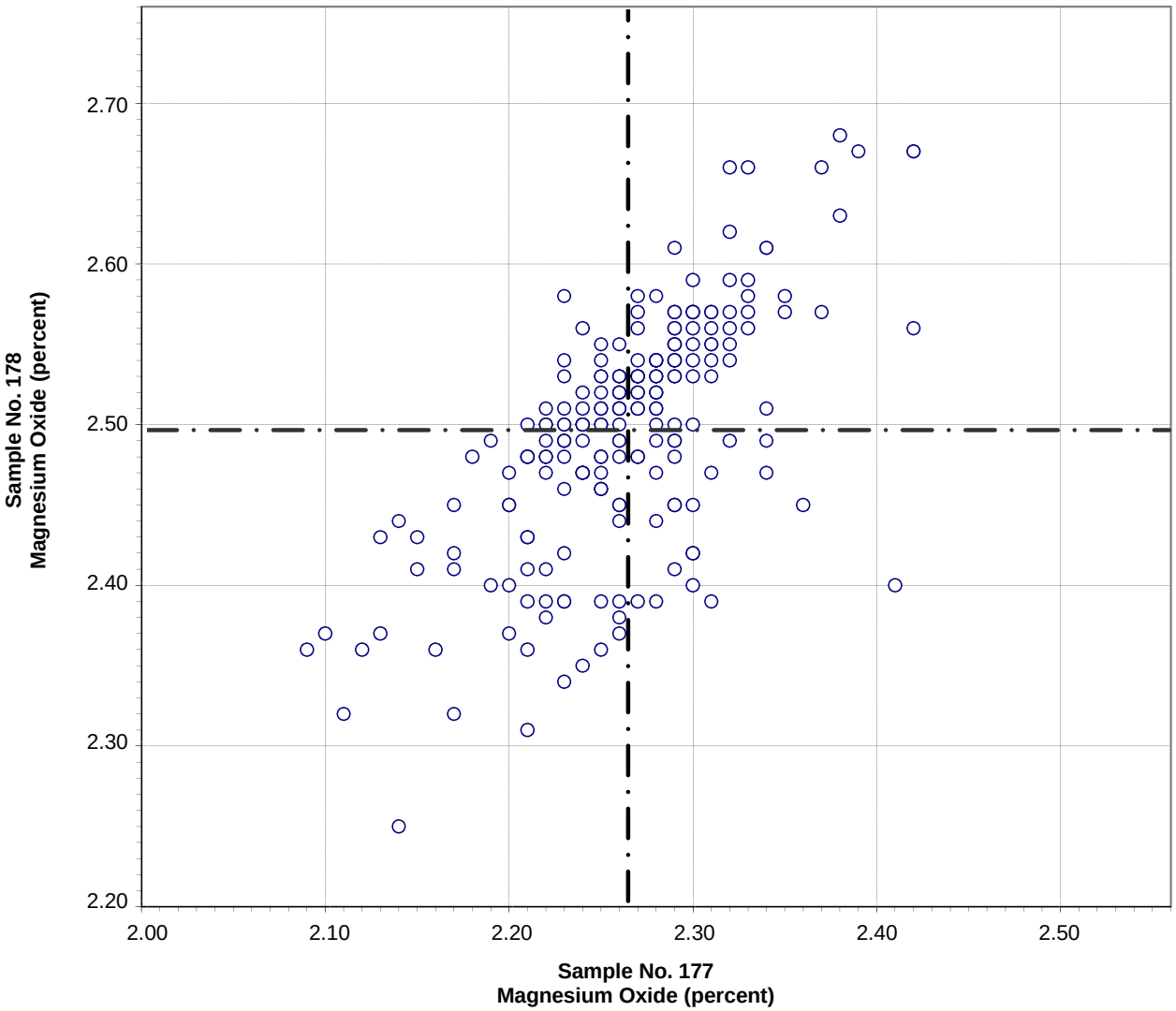


Test No. 40 Calcium Oxide 213 Points

Sample No. 177	Ave	63.58	S.D.	0.33	C.V.	0.5
Sample No. 178	Ave	63.68	S.D.	0.43	C.V.	0.7

Labs eliminated: 23, 50, 407, 2621, 289, 2464, 3059, 3428, 3454

CCRL Proficiency Sample Program
Magnesium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

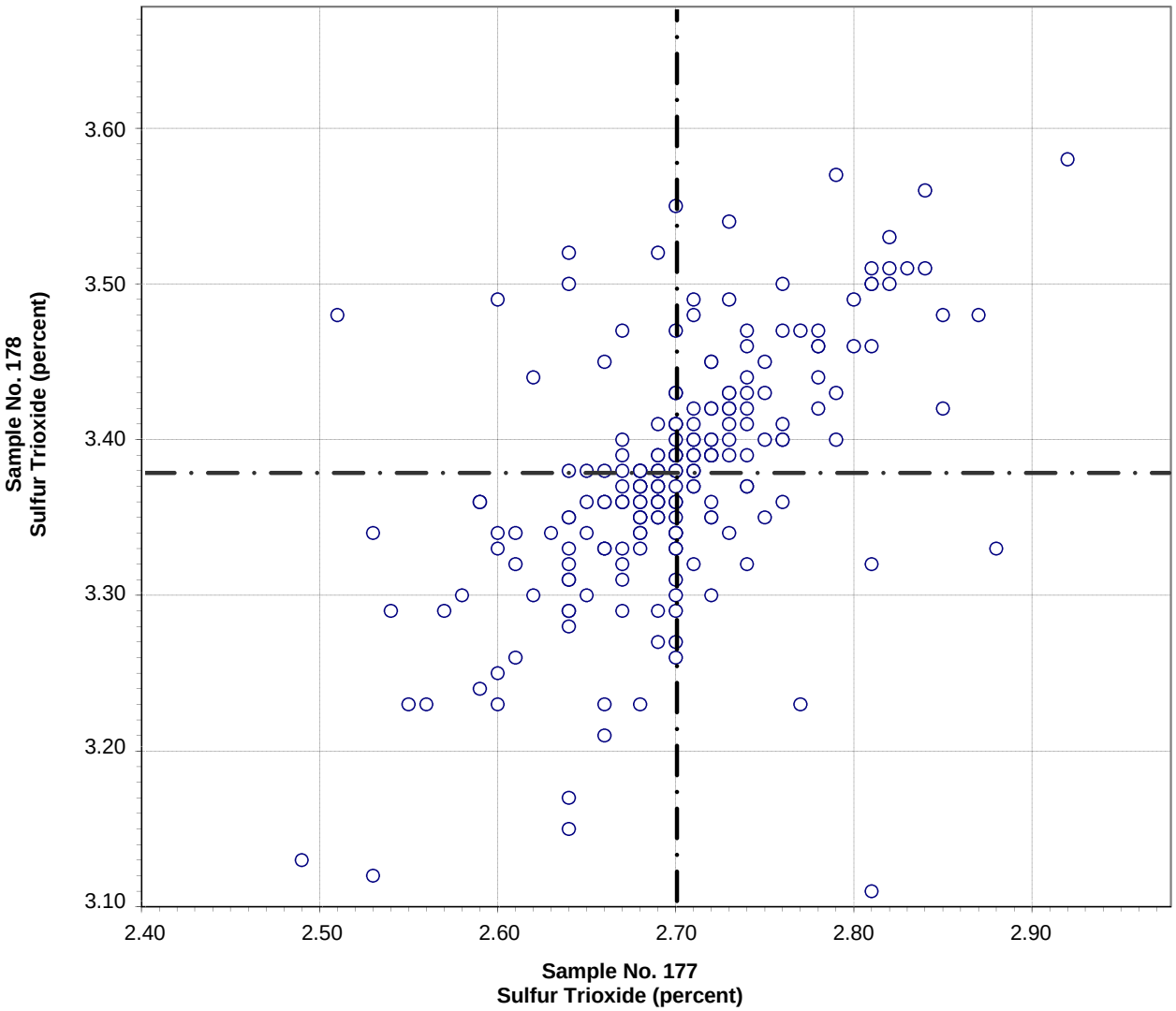


Test No. 50 Magnesium Oxide 211 Points

Sample No. 177	Ave	2.26	S.D.	0.06	C.V.	2.5
Sample No. 178	Ave	2.50	S.D.	0.07	C.V.	3.0

Labs eliminated: 53, 289, 407, 416, 95, 206, 696, 1594, 1644, 2463, 2466, 3454

CCRL Proficiency Sample Program
Sulfur Trioxide
PORTLAND CEMENT Samples No. 177 and No. 178

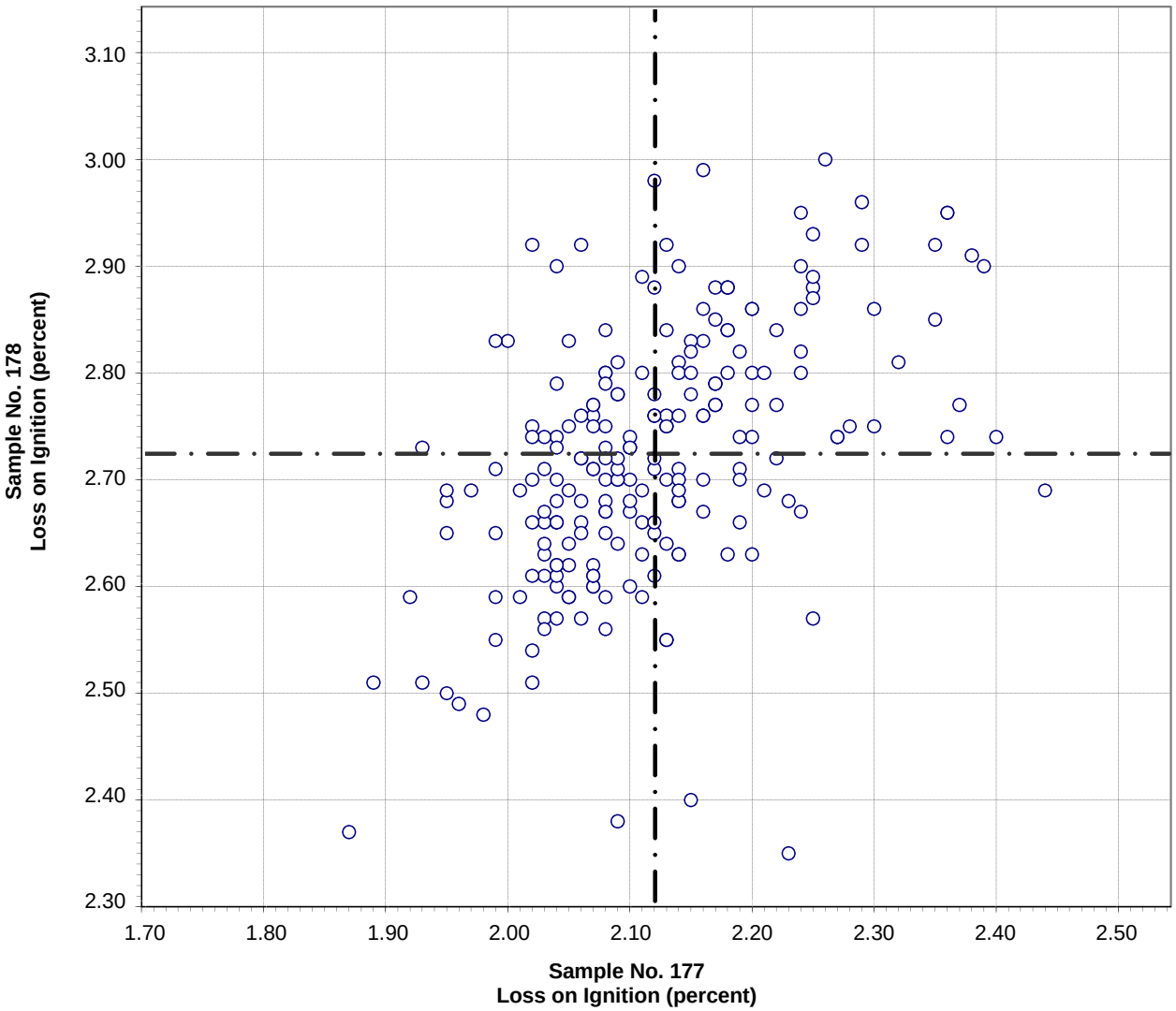


Test No. 60 Sulfur Trioxide 213 Points

Sample No. 177	Ave	2.70	S.D.	0.07	C.V.	2.5
Sample No. 178	Ave	3.38	S.D.	0.08	C.V.	2.4

Labs eliminated: 51, 53, 407, 696, 4, 40, 156, 416, 501, 1956, 2305, 2483, 3279, 3454

CCRL Proficiency Sample Program
Loss on Ignition
PORTLAND CEMENT Samples No. 177 and No. 178

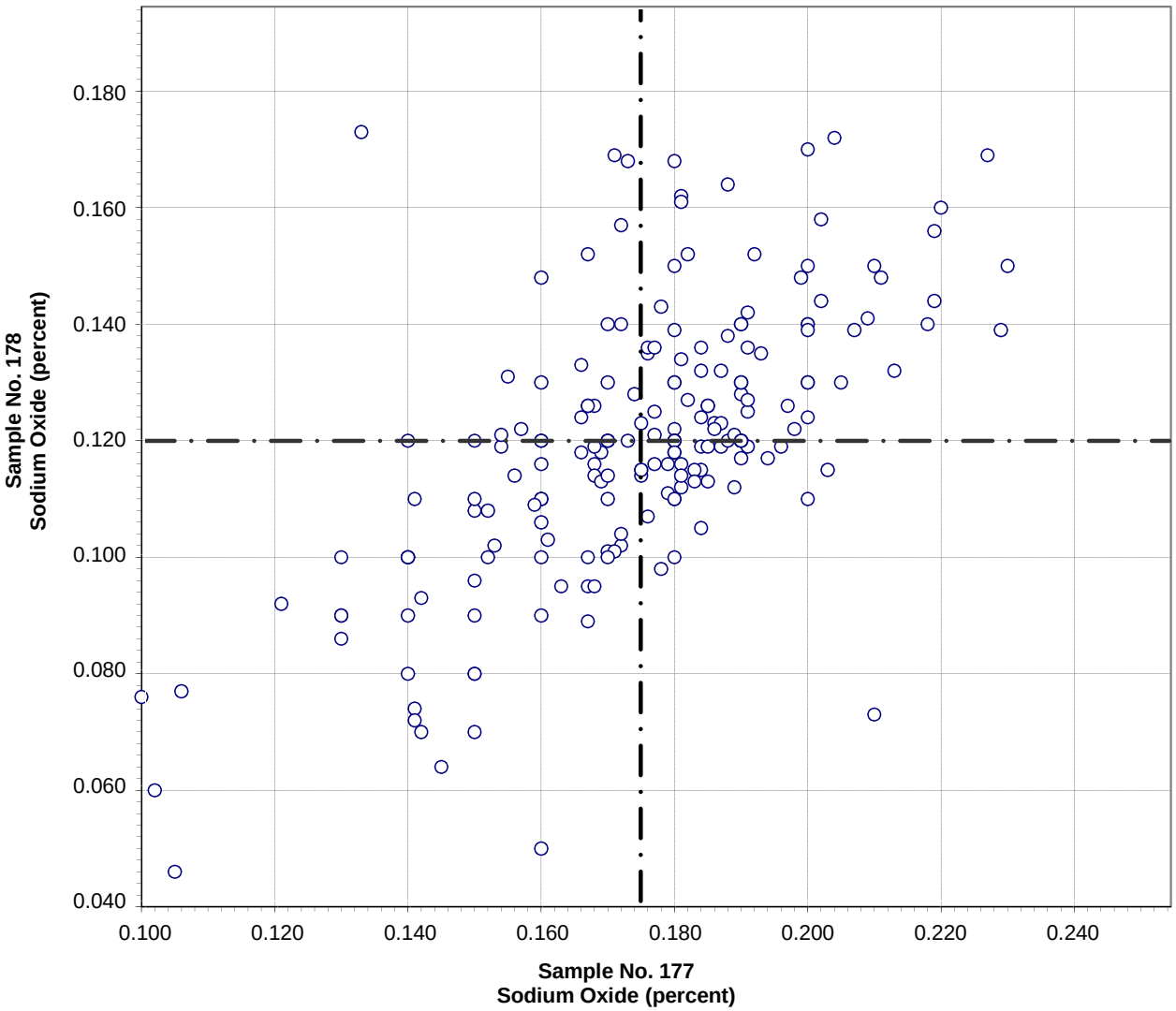


Test No. 70 Loss on Ignition 214 Points

Sample No. 177 Ave 2.12 S.D. 0.10 C.V. 4.8
Sample No. 178 Ave 2.72 S.D. 0.12 C.V. 4.3

Labs eliminated: 51, 90, 203, 1644, 2491, 2763, 206, 221, 431, 1466, 3059, 3415

CCRL Proficiency Sample Program
Sodium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

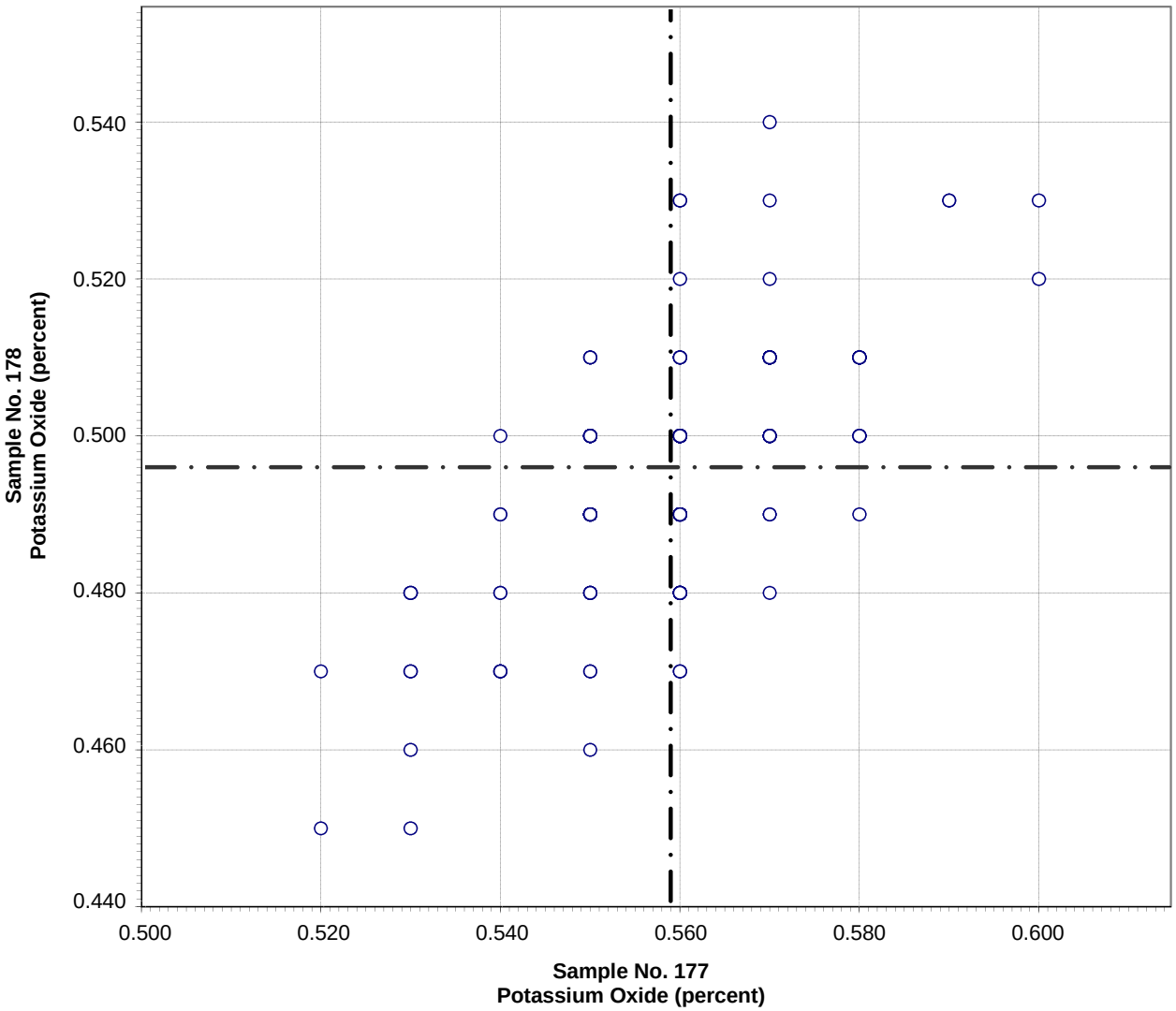


Test No. 90 Sodium Oxide 198 Points

Sample No. 177	Ave	0.175	S.D.	0.023	C.V.	13.2
Sample No. 178	Ave	0.120	S.D.	0.023	C.V.	19.3

Labs eliminated: 53, 78, 98, 110, 125, 1053, 1251, 4, 458, 696, 1956, 2463, 2464, 3057, 3238

CCRL Proficiency Sample Program
Potassium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

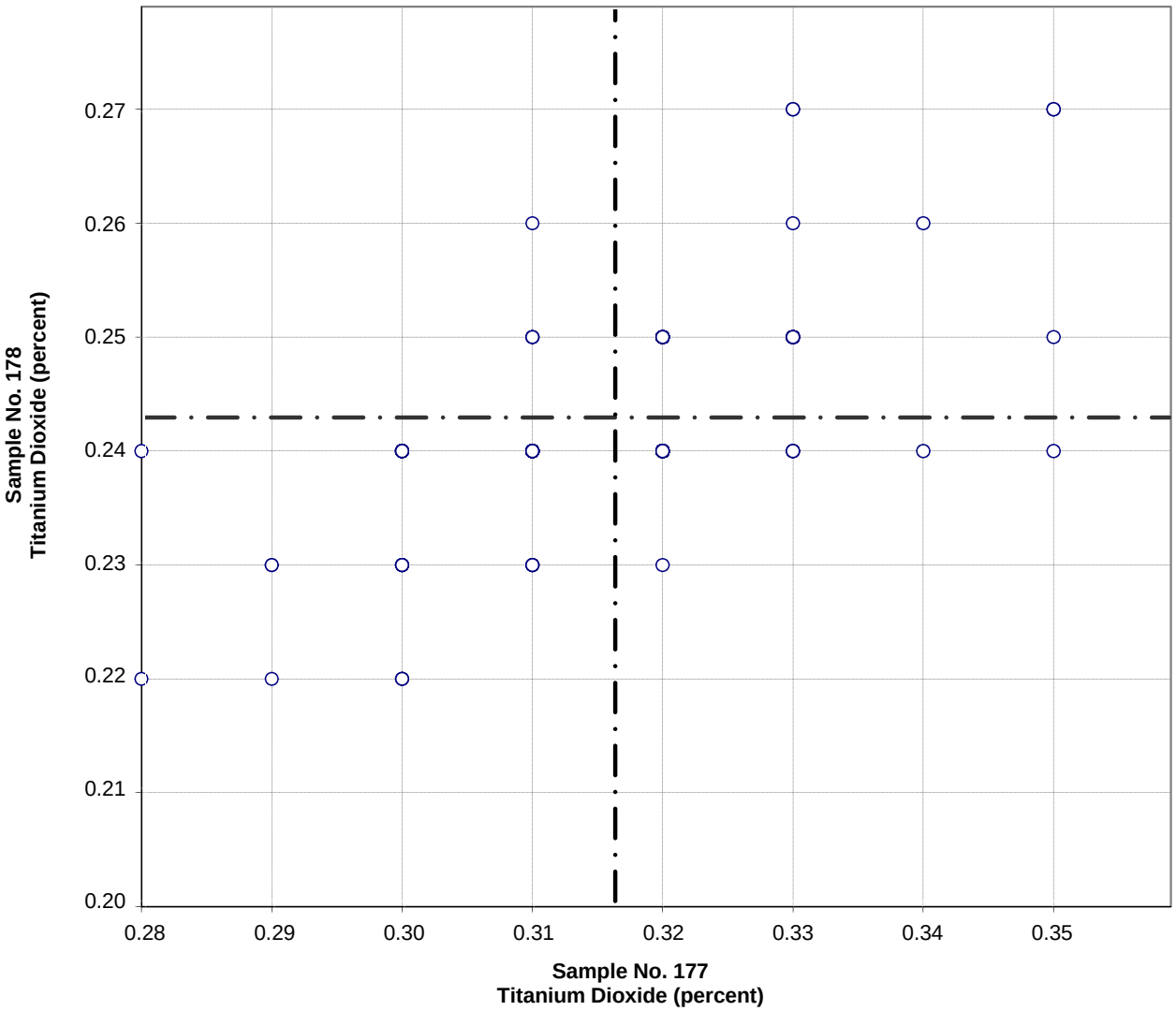


Test No. 100 Potassium Oxide 201 Points

Sample No. 177	Ave	0.559	S.D.	0.013	C.V.	2.2
Sample No. 178	Ave	0.496	S.D.	0.014	C.V.	2.8

Labs eliminated: 36, 158, 178, 407, 416, 2463, 3233, 3415, 1, 107, 206, 696, 768, 1190, 2253, 3057, 3454

CCRL Proficiency Sample Program
Titanium Dioxide
PORTLAND CEMENT Samples No. 177 and No. 178

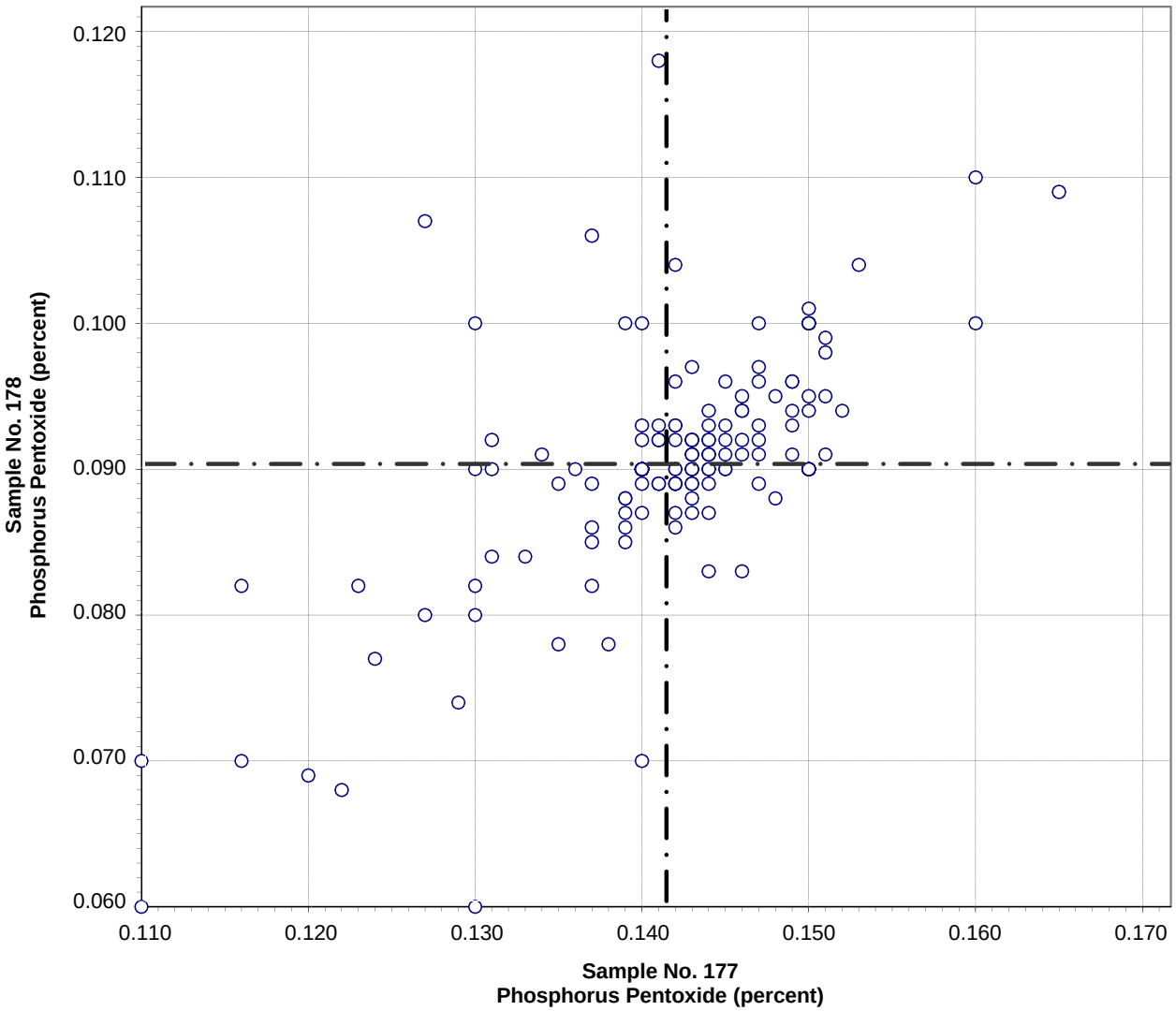


Test No. 103 Titanium Dioxide 171 Points

Sample No. 177 Ave 0.32 S.D. 0.012 C.V. 3.7
Sample No. 178 Ave 0.24 S.D. 0.009 C.V. 3.5

Labs eliminated: 84, 107, 53, 407, 696, 768, 2491

CCRL Proficiency Sample Program
Phosphorus Pentoxide
PORTLAND CEMENT Samples No. 177 and No. 178

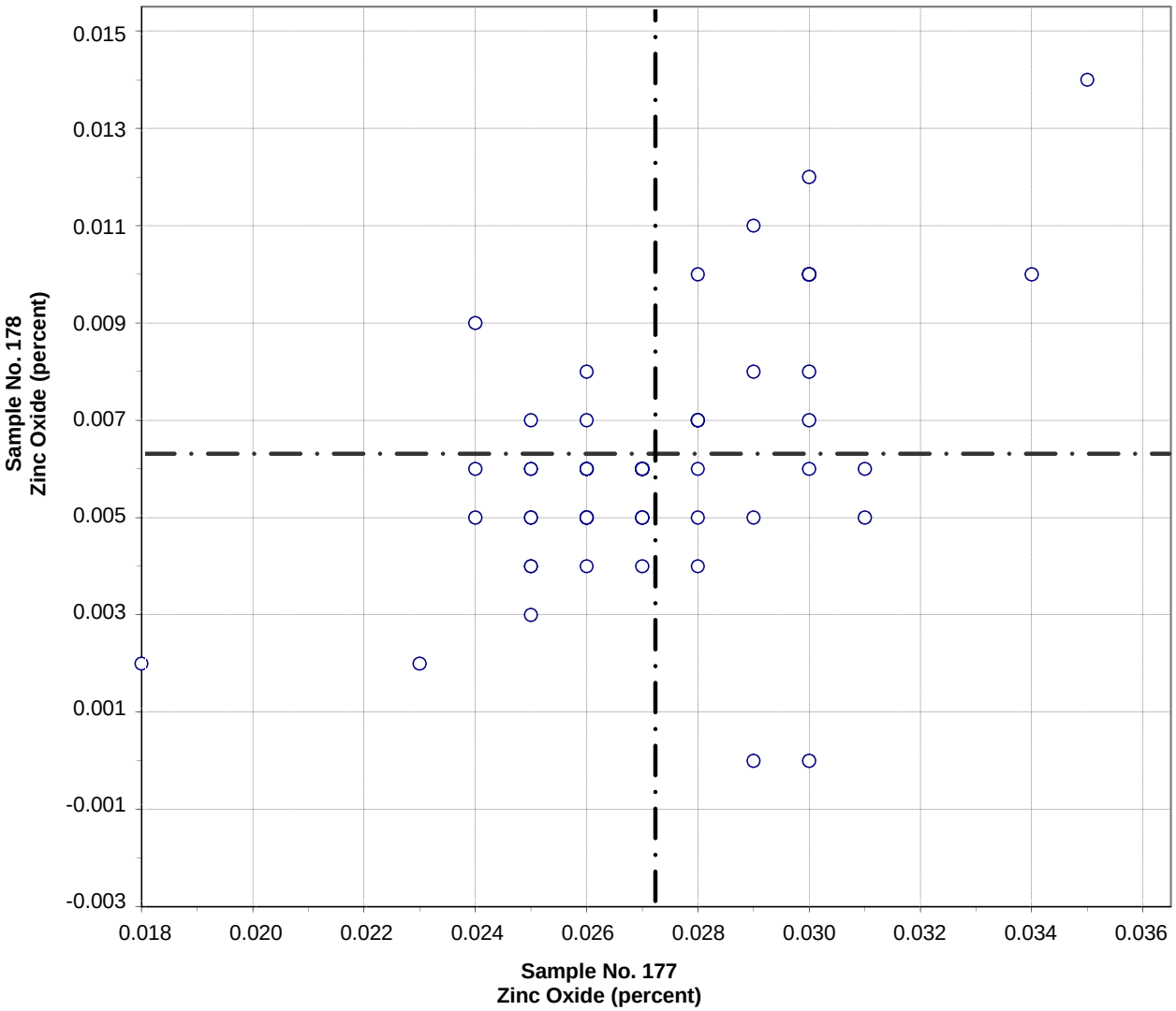


Test No. 102 Phosphorus Pentoxide 163 Points

Sample No. 177	Ave	0.141	S.D.	0.008	C.V.	5.7
Sample No. 178	Ave	0.090	S.D.	0.008	C.V.	8.6

Labs eliminated: 92, 98, 1799, 2116, 4, 53, 107, 139, 696, 2463, 2484, 3291

CCRL Proficiency Sample Program
Zinc Oxide
PORTLAND CEMENT Samples No. 177 and No. 178



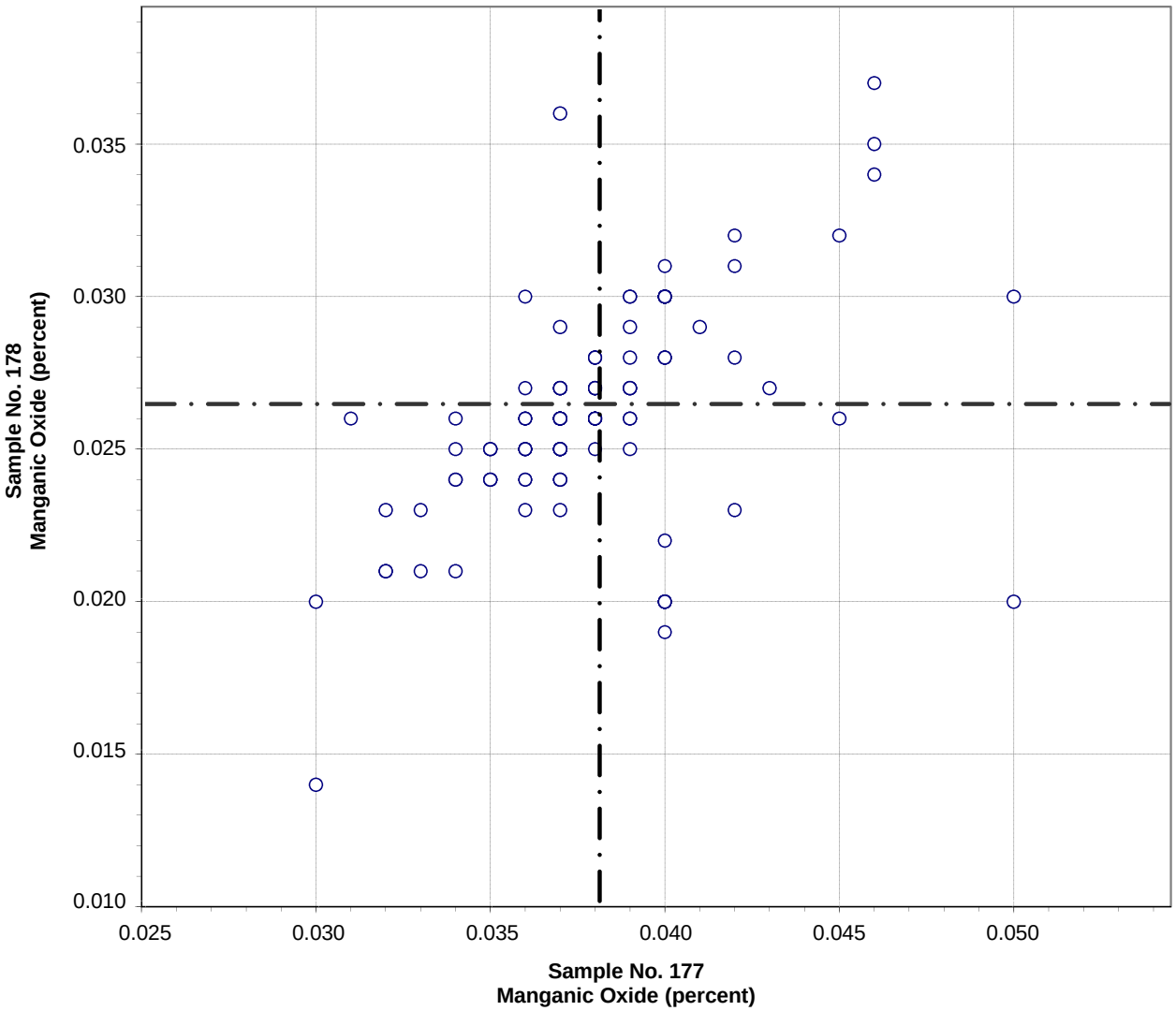
Test No. 99 Zinc Oxide 73 Points

Sample No. 177	Ave	0.027	S.D.	0.003	C.V.	10.1
Sample No. 178	Ave	0.006	S.D.	0.003	C.V.	41.3

Labs eliminated: 74, 95, 206, 408, 696, 1466, 2934

Labs off Diagram: 493

CCRL Proficiency Sample Program
Manganic Oxide
PORTLAND CEMENT Samples No. 177 and No. 178



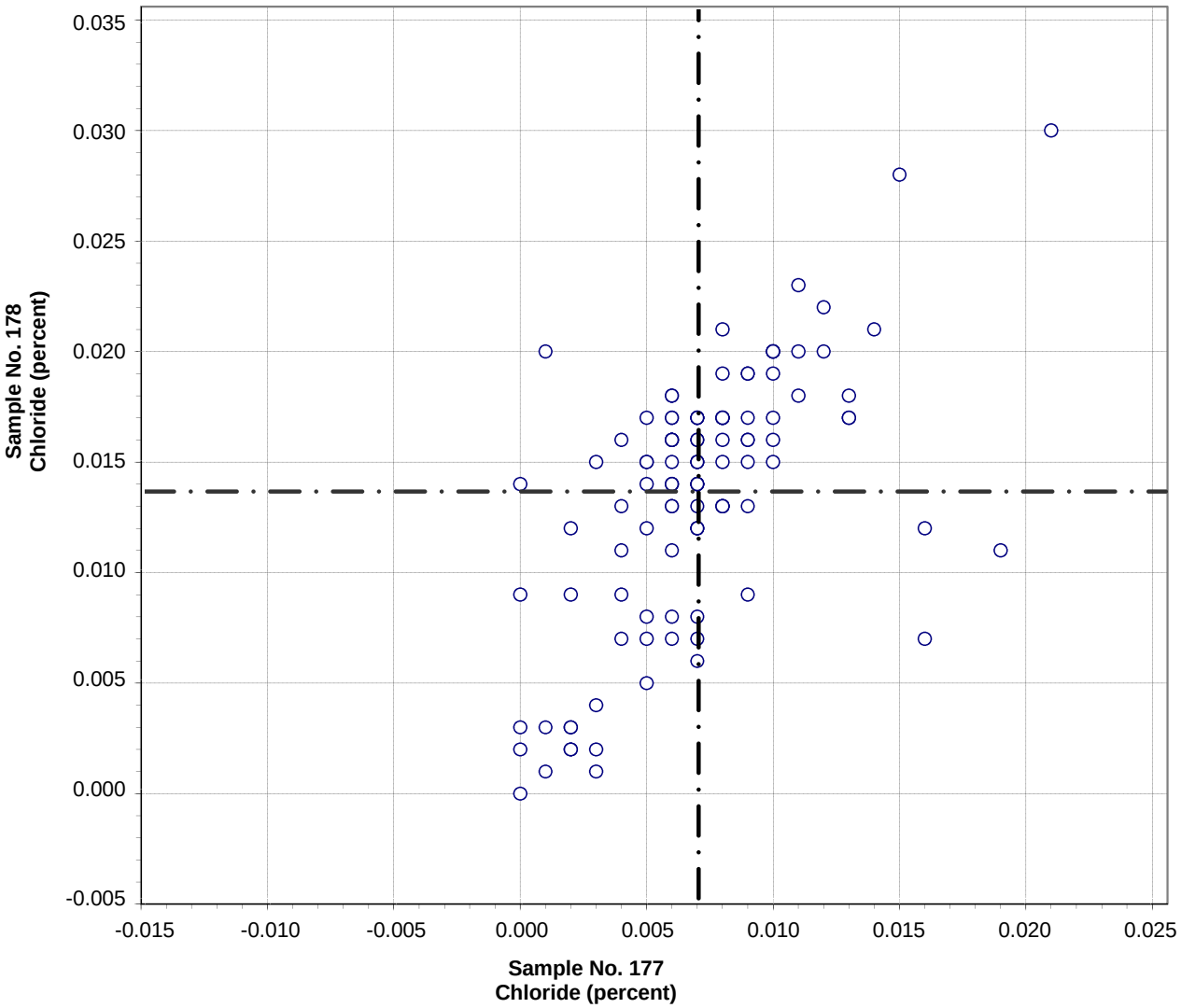
Test No. 101 Manganic Oxide 125 Points

Sample No. 177	Ave	0.038	S.D.	0.004	C.V.	9.2
Sample No. 178	Ave	0.026	S.D.	0.004	C.V.	14.8

Labs eliminated: 162, 181, 354, 407, 692, 2463

Labs off Diagram: 107, 209

CCRL Proficiency Sample Program
Chloride
PORTLAND CEMENT Samples No. 177 and No. 178

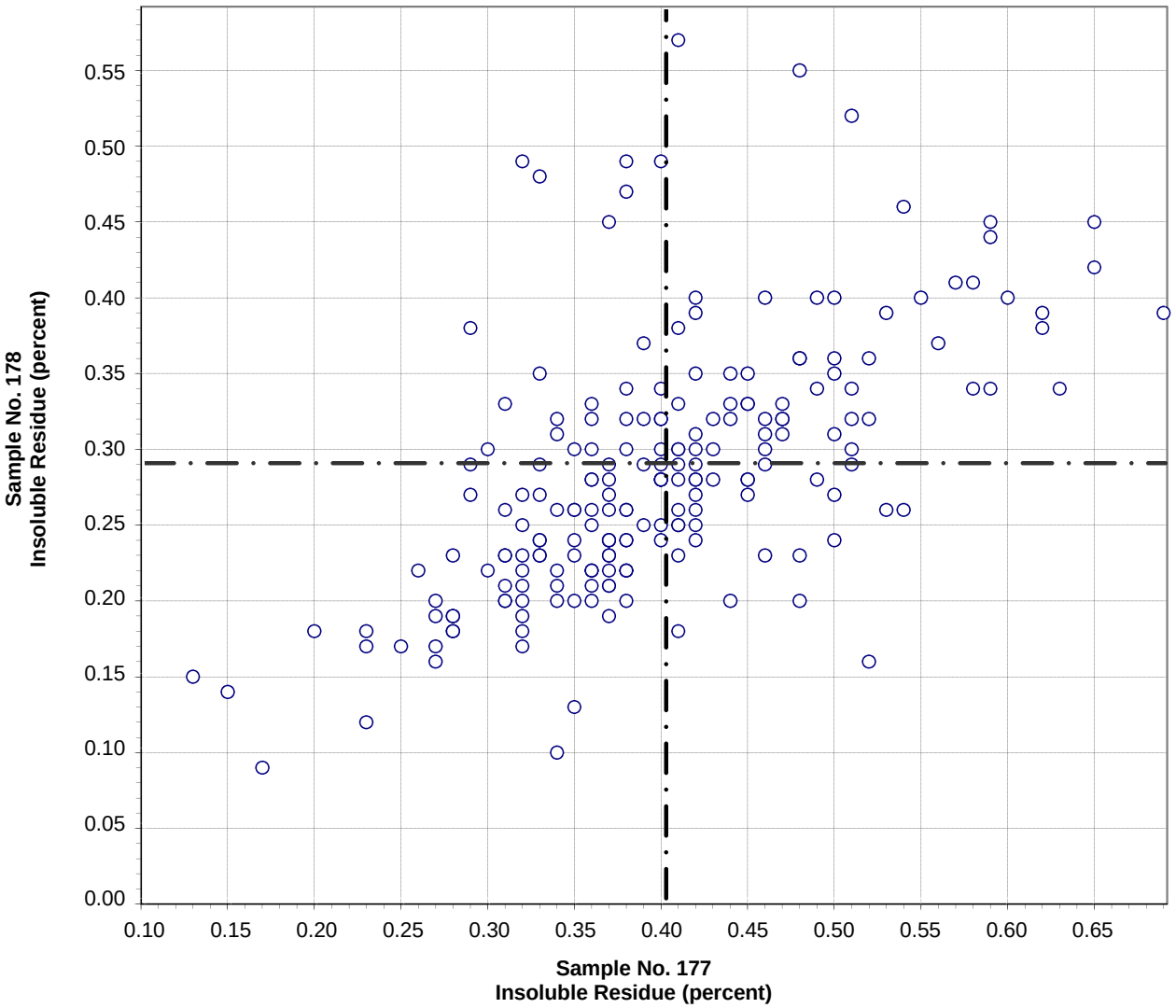


Test No. 104 Chloride 109 Points

Sample No. 177	Ave	0.007	S.D.	0.004	C.V.	54.7
Sample No. 178	Ave	0.014	S.D.	0.006	C.V.	42.7

Labs eliminated: 181, 206, 457, 3428

CCRL Proficiency Sample Program
Insoluble Residue
PORTLAND CEMENT Samples No. 177 and No. 178



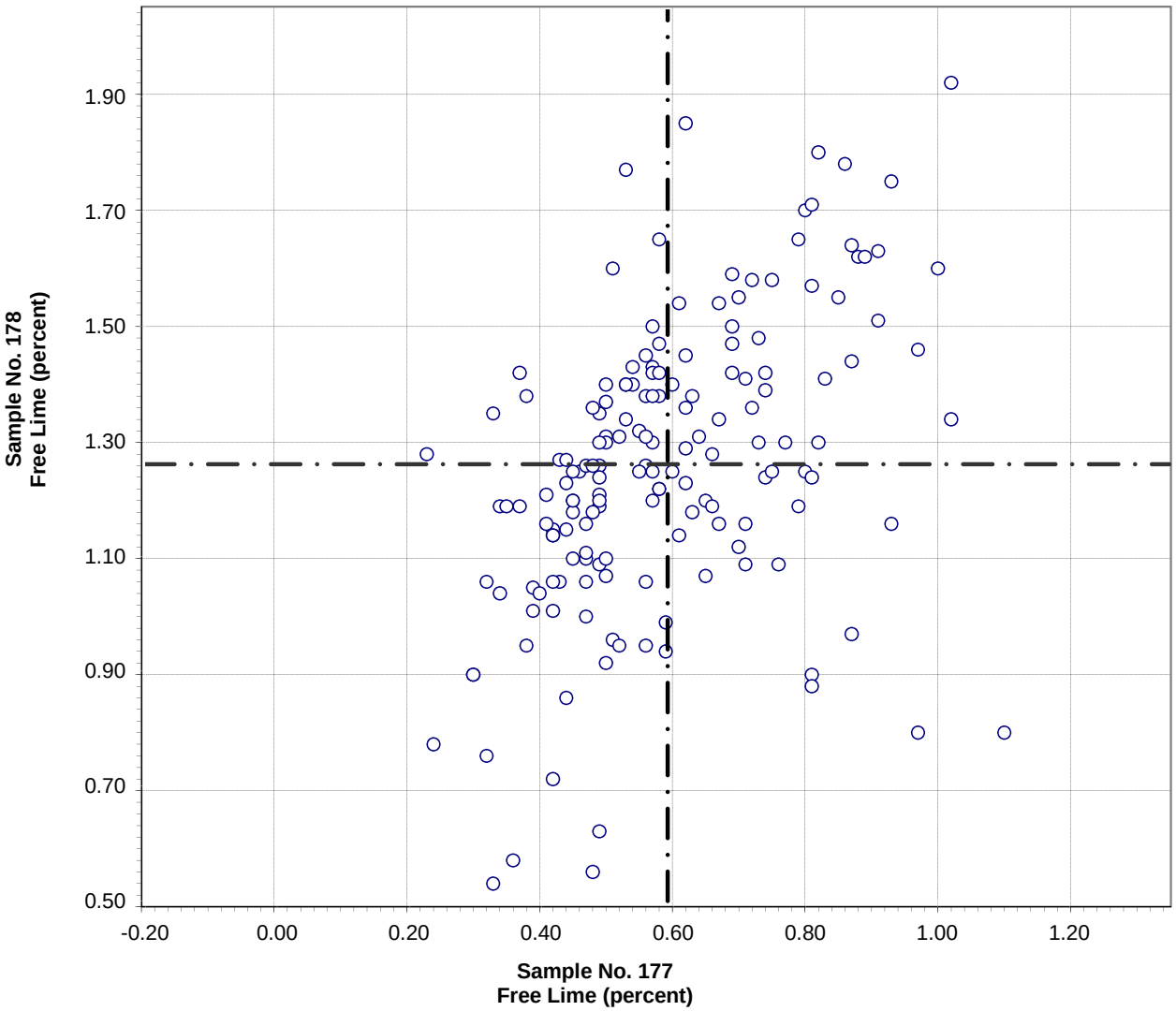
Test No. 80 Insoluble Residue 205 Points

Sample No. 177	Ave	0.40	S.D.	0.10	C.V.	23.8
Sample No. 178	Ave	0.29	S.D.	0.09	C.V.	32.1

Labs eliminated: 206, 605, 3415, 3454

Labs off Diagram: 1025, 3233, 3235

CCRL Proficiency Sample Program
Free Lime
PORTLAND CEMENT Samples No. 177 and No. 178

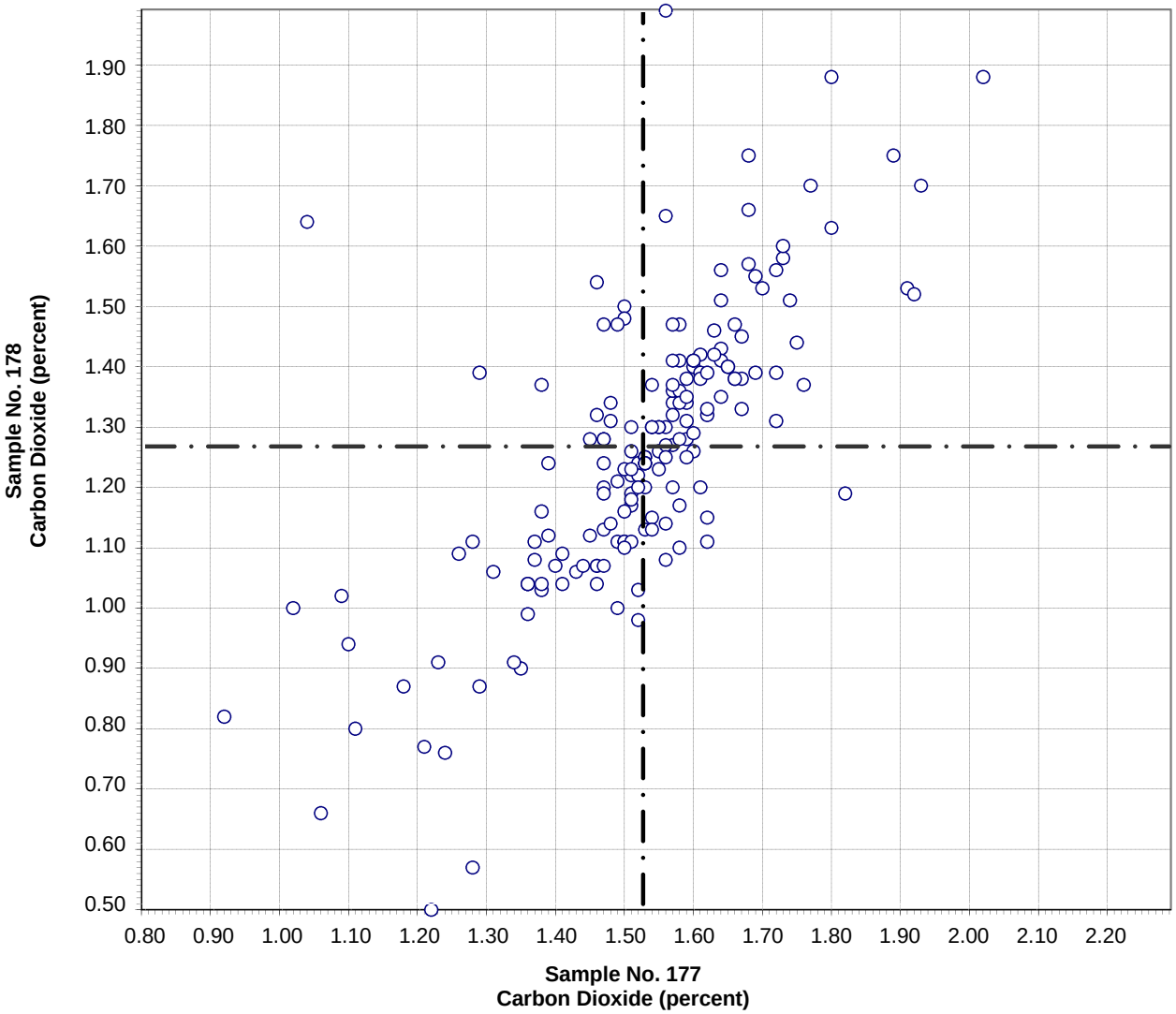


Test No. 41 Free Lime 166 Points

Sample No. 177	Ave	0.59	S.D.	0.18	C.V.	29.8
Sample No. 178	Ave	1.26	S.D.	0.25	C.V.	20.1

Labs eliminated: 284, 494, 2363, 2490, 3235

CCRL Proficiency Sample Program
Carbon Dioxide
PORTLAND CEMENT Samples No. 177 and No. 178

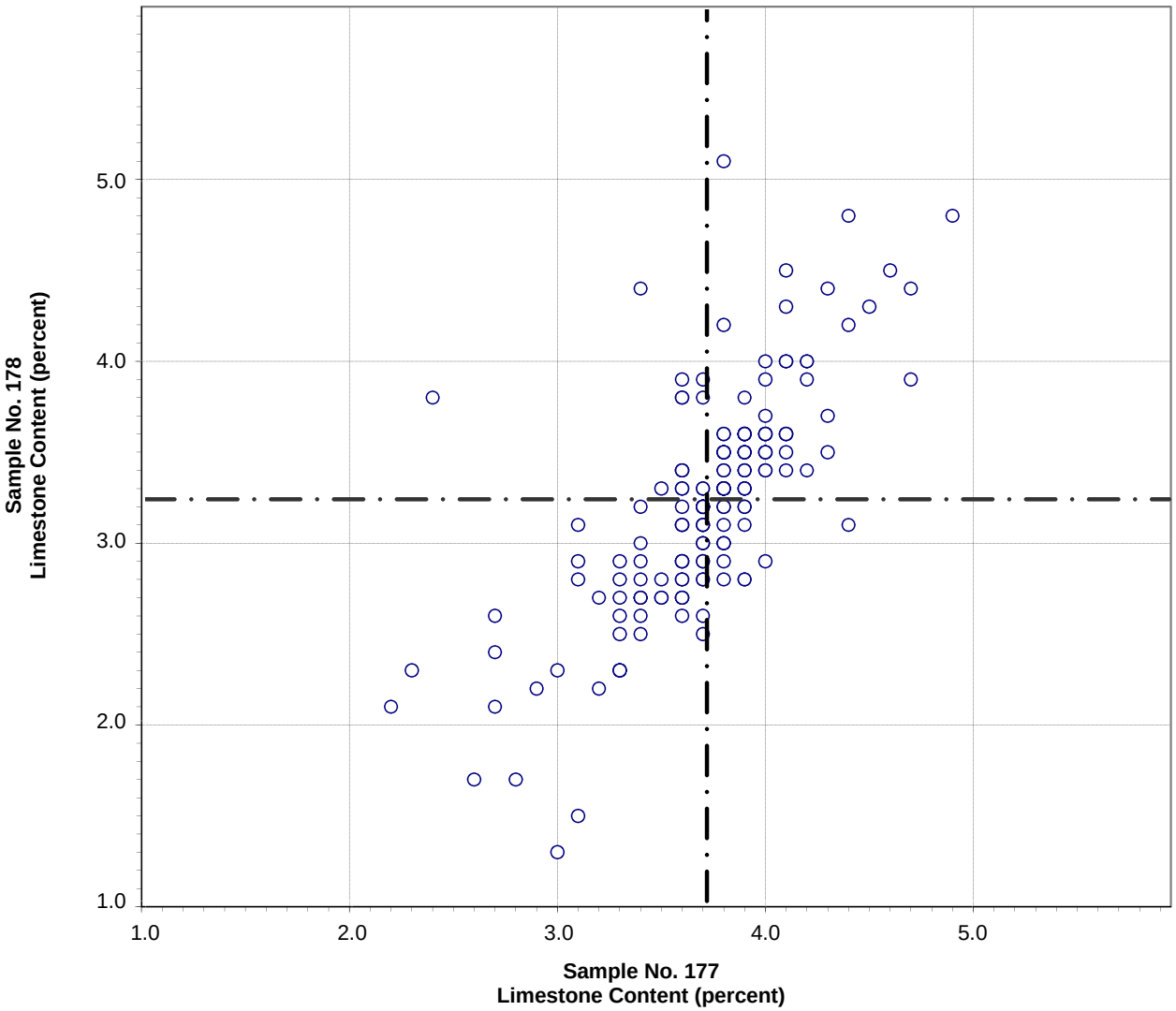


Test No. 97 Carbon Dioxide 175 Points

Sample No. 177	Ave	1.53	S.D.	0.17	C.V.	11.1
Sample No. 178	Ave	1.27	S.D.	0.23	C.V.	18.3

Labs eliminated: 56, 66, 162, 975, 2466

CCRL Proficiency Sample Program
Limestone Content
PORTLAND CEMENT Samples No. 177 and No. 178

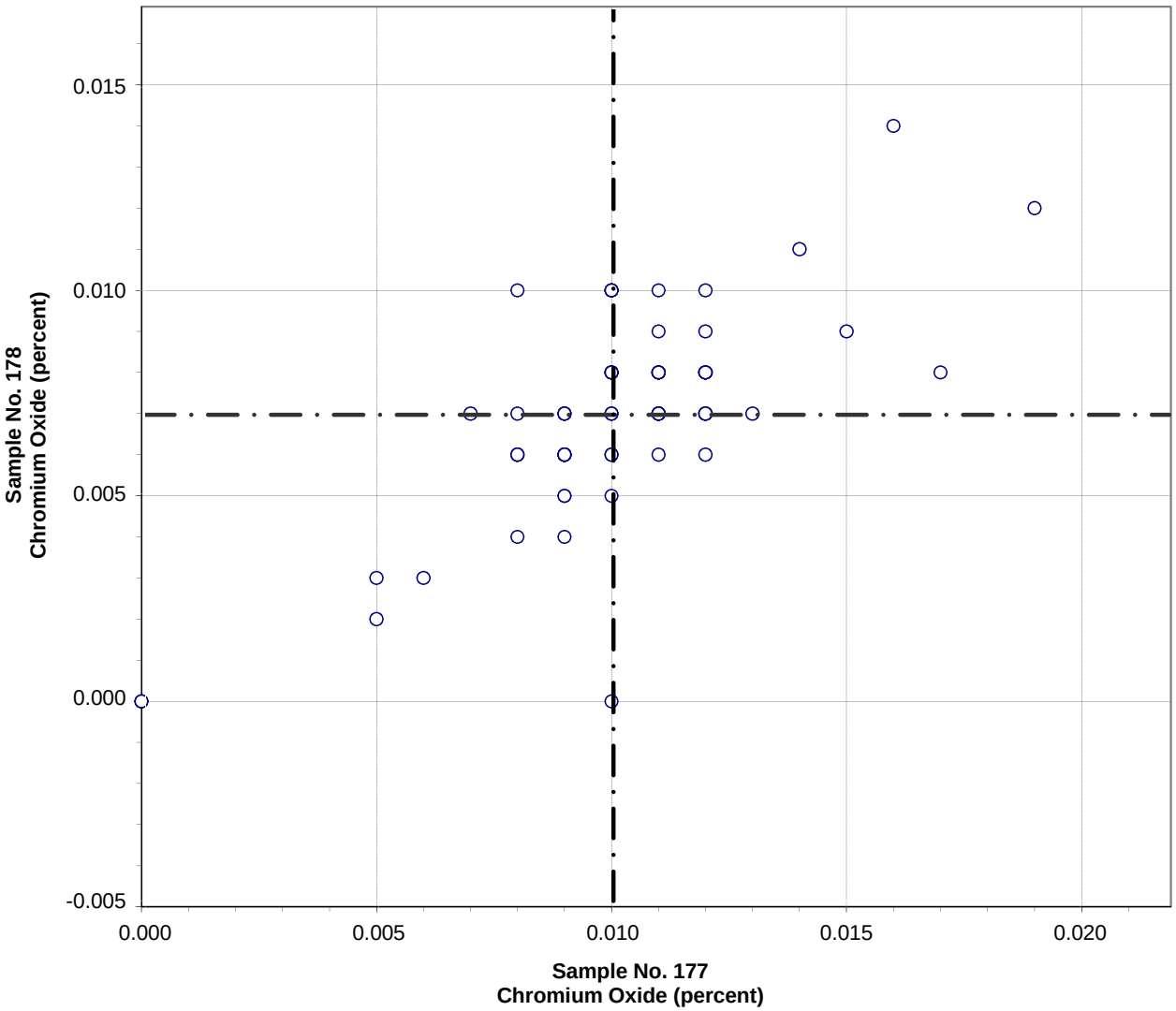


Test No. 98 Limestone Content 171 Points

Sample No. 177	Ave	3.7	S.D.	0.4	C.V.	11.4
Sample No. 178	Ave	3.2	S.D.	0.6	C.V.	18.8

Labs eliminated: 56, 66, 162, 975, 2466, 2477

CCRL Proficiency Sample Program
Chromium Oxide
PORTLAND CEMENT Samples No. 177 and No. 178

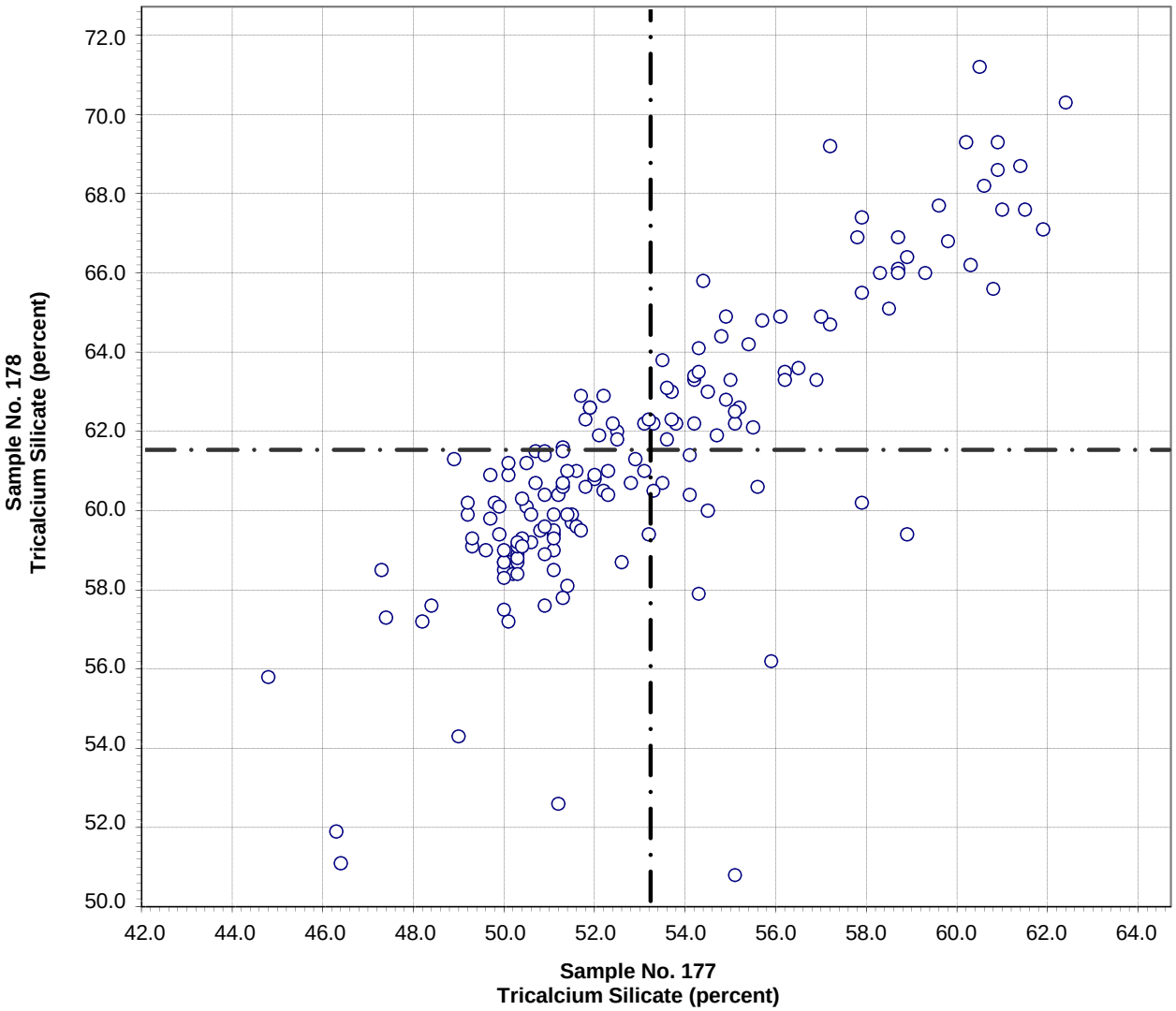


Test No. 105 Chromium Oxide 75 Points

Sample No. 177	Ave	0.010	S.D.	0.003	C.V.	30.4
Sample No. 178	Ave	0.007	S.D.	0.003	C.V.	36.7

Labs eliminated: 415, 1956, 2462

CCRL Proficiency Sample Program
Tricalcium Silicate
PORTLAND CEMENT Samples No. 177 and No. 178

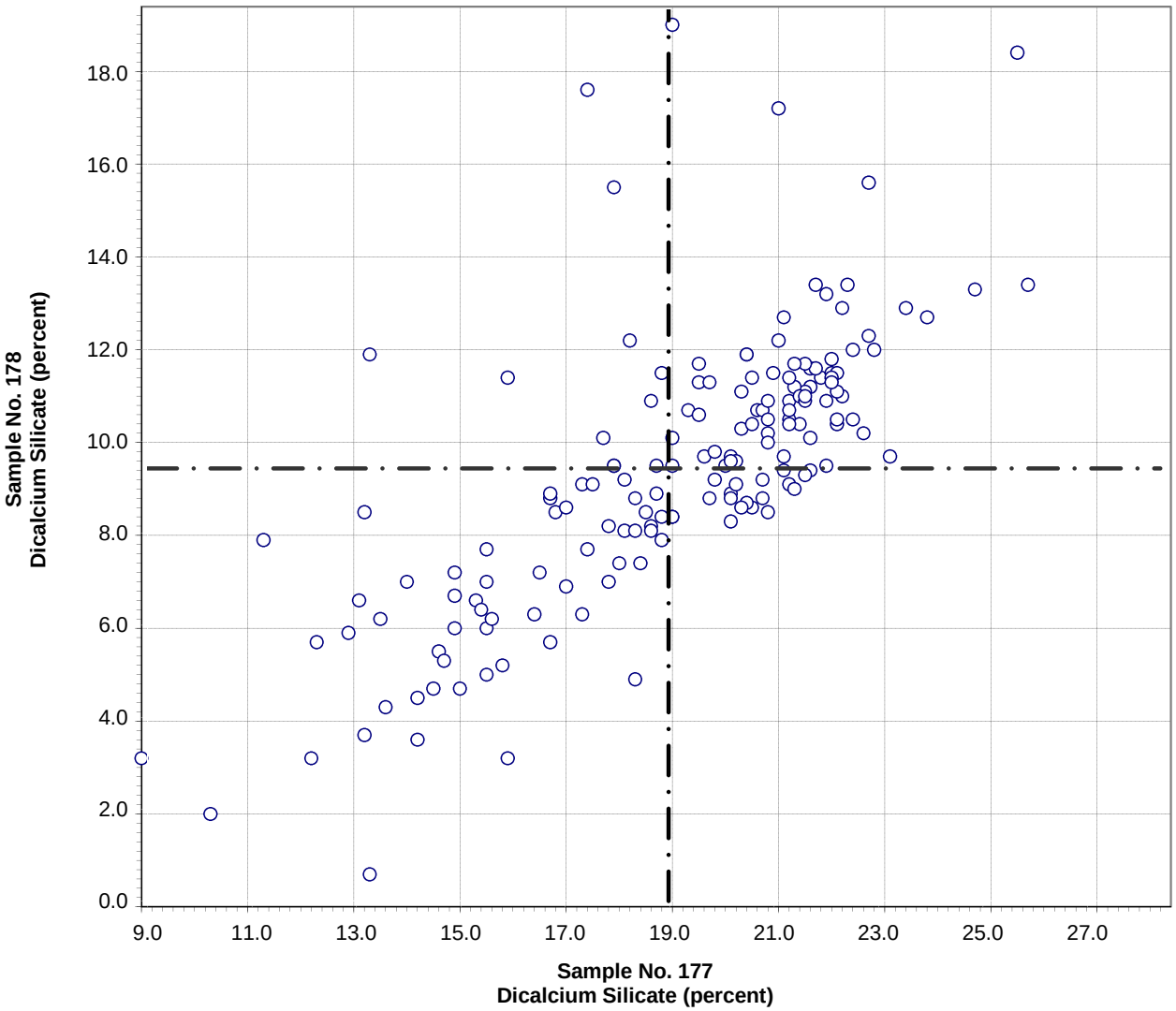


Test No. 106 Tricalcium Silicate 163 Points

Sample No. 177	Ave	53.2	S.D.	3.6	C.V. 6.8
Sample No. 178	Ave	61.5	S.D.	3.5	C.V. 5.7

Labs eliminated: 8, 407, 2463, 2477, 2621

CCRL Proficiency Sample Program
Dicalcium Silicate
PORTLAND CEMENT Samples No. 177 and No. 178

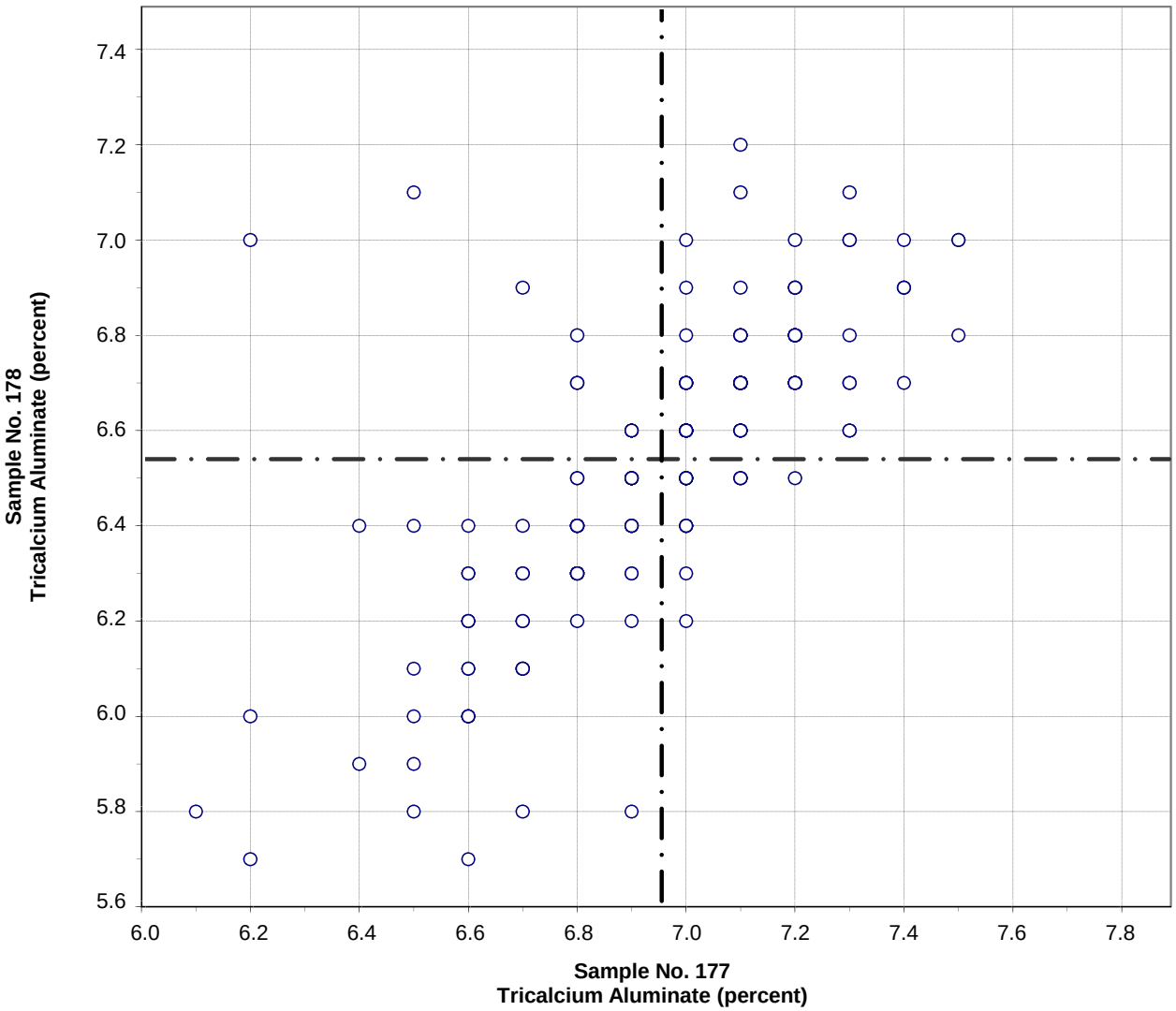


Test No. 107 Dicalcium Silicate 165 Points

Sample No. 177 Ave 19.0 S.D. 3.1 C.V. 16.4
Sample No. 178 Ave 9.4 S.D. 2.9 C.V. 31.2

Labs eliminated: 93, 2463, 2621

CCRL Proficiency Sample Program
Tricalcium Aluminate
PORTLAND CEMENT Samples No. 177 and No. 178

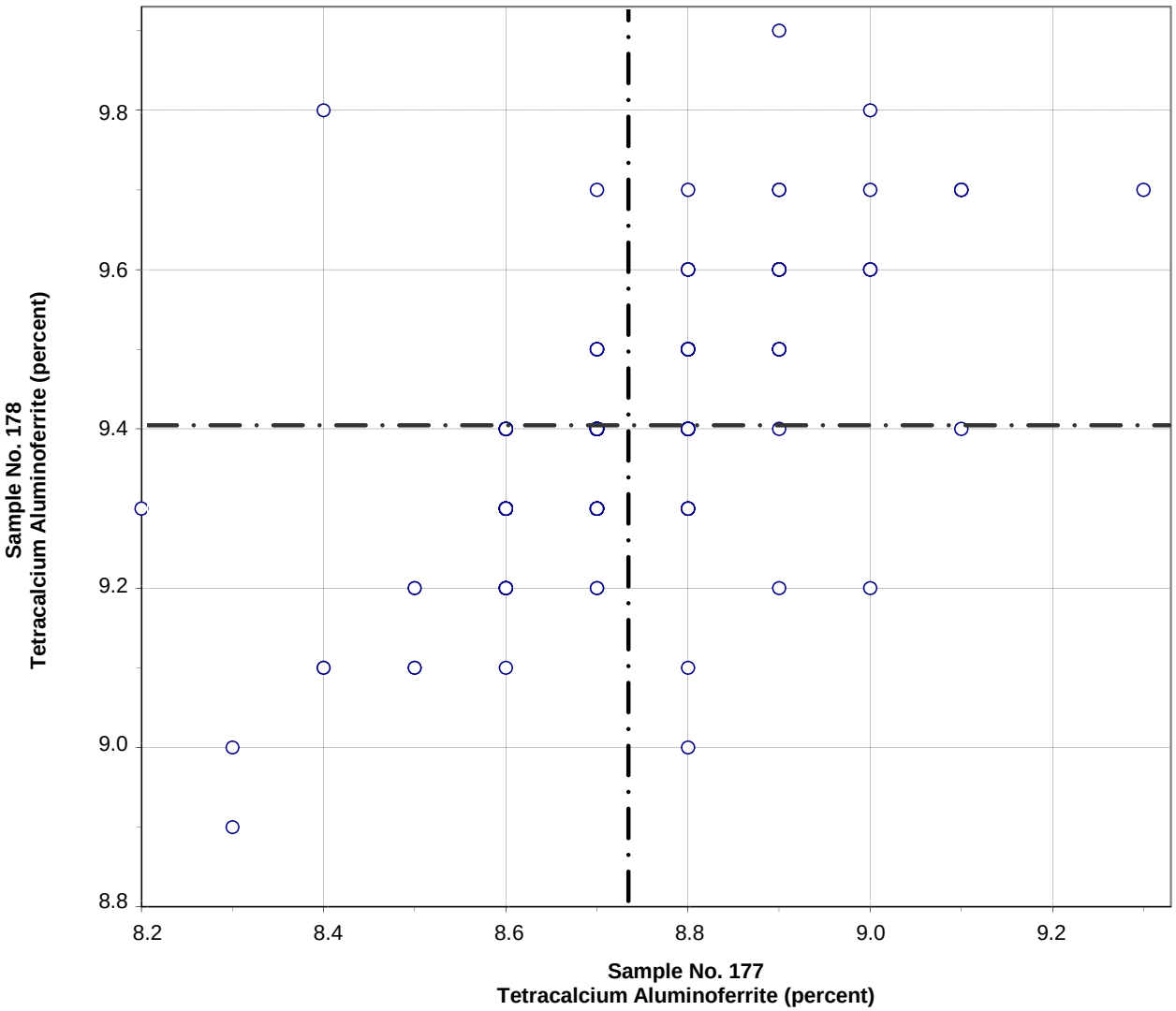


Test No. 108 Tricalcium Aluminate 186 Points

Sample No. 177	Ave	7.0	S.D.	0.3	C.V.	3.6
Sample No. 178	Ave	6.5	S.D.	0.3	C.V.	4.5

Labs eliminated: 124, 289, 2464, 2491, 38, 975, 2463, 3454

CCRL Proficiency Sample Program
Tetracalcium Aluminoferrite
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 109 Tetracalcium Aluminoferrite 179 Points

Sample No. 177 Ave 8.7 S.D. 0.2 C.V. 1.8
Sample No. 178 Ave 9.4 S.D. 0.2 C.V. 1.8

Labs eliminated: 66, 209, 124, 206, 289, 407, 504, 696, 2491, 3454

Labs off Diagram: 165, 502

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 177 and No. 178
Final Report - Physical Results
September 10, 2010

SUMMARY OF RESULTS

			Sample No. 177			Sample No. 178		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
N.C. Water	%	239	24.4	8.8	36.0	26.0	9.4	36.1
N.C. Water	%	* 234	23.9	0.4	1.9	25.5	0.5	1.9
Vicat TS Initial	min	233	114	14	12.0	93	15	16.0
Vicat TS Initial	min	* 225	113	11	9.8	92	12	12.7
Vicat TS Final	min	225	217	29	13.5	189	29	15.1
Vicat TS Final	min	* 222	217	27	12.3	189	28	14.9
Gillmore TS Intial	min	145	150	22	14.4	129	26	20.2
Gillmore TS Intial	min	* 142	149	21	13.8	127	21	16.4
Gillmore TS Final	min	144	246	36	14.6	220	36	16.4
Gillmore TS Final	min	* 141	247	31	12.6	219	34	15.6
False Set	%	185	80	8.9	11.2	76	9.0	11.9
False Set	%	* 183	80	8.7	10.9	76	8.6	11.4
Autoclave Expan	%	222	-0.01	0.03	268	0.03	0.05	165
Autoclave Expan	%	* 212	-0.007	0.01	189	0.03	0.02	72

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* ELIMINATED LABS: Data over three S.D. from the mean

Normal Consistency 3 169 255 3144 3233

Vicat TS Initial 4 69 95 176 360 440 1483 3144

Vicat TS Final 52 69 3144

Gillmore TS Initial 126 360 3144

Gillmore TS Final 52 126 3144

False Set - Paste Method 126 162

Autoclave Expansion 95 105 309 354 25 975 1435 1940 2464 3057

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 177 and No. 178
Final Report - Physical Results
September 10, 2010

SUMMARY OF RESULTS

			Sample No. 177			Sample No. 178		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Air Content	%	216	8.8	1.3	14.6	8.5	1.9	22.4
Air Content	%	* 210	8.7	1.1	12.6	8.4	1.1	13.7
AC Mix Water	%	212	72.8	27.2	37.4	72.7	27.9	38.4
AC Mix Water	%	* 199	68.9	2.4	3.4	68.7	2.5	3.6
AC Flow	%	214	86	4.4	5.1	88	3.4	3.9
AC Flow	%	* 212	86	3.7	4.3	88	3.4	3.8
Comp Str, 3 day	psi	244	3637	236	6.5	4225	353	8.4
Comp Str, 3 day	psi	* 239	3644	214	5.9	4245	299	7.0
Comp Str, 7 day	psi	241	4717	306	6.5	5121	397	7.8
Comp Str, 7 day	psi	* 232	4733	265	5.6	5150	303	5.9
Comp Str, 28 day	psi	221	6308	466	7.4	6237	508	8.1
Comp Str, 28 day	psi	* 216	6316	407	6.4	6250	420	6.7
Com Str, Flow	%	214	116	11	9.6	119	11	9.6
Com Str, Flow	%	* 210	116	9	7.6	120	9	7.6

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* ELIMINATED LABS: Data over three S.D. from the mean

Air Content % 25 56 416 1435 1657 2490

Air Content - % Water 18 66 162 289 126 408 694 982 80 360 1435 2464 3144

Air Content - Flow 252 3015

Comp Strength - 3 day 14 18 48 1773 3511

Comp Strength - 7 day 14 416 1773 37 49 52 1435 1956 3511

Comp Strength - 28 day 9 14 24 84 1773

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 177 and No. 178
Final Report - Physical Results
September 10, 2010

SUMMARY OF RESULTS

Test		#Labs	Sample No. 177 Average	S.D.	C.V.	Sample No. 178 Average	S.D.	C.V.
FINENESS								
Air Permeability	cm^2/g	236	3842	131	3.4	4038	138	3.4
Air Permeability	cm^2/g	* 227	3839	87	2.3	4035	102	2.5
Wagner Turbidim	cm^2/g	9	2043	100	4.9	2210	59	2.7
45µm Sieve	%	224	90.89	1.81	2.0	97.56	0.75	0.8
45µm Sieve	%	* 209	90.89	1.31	1.4	97.67	0.36	0.4
C1038 MORTAR BAR EXPANSION								
Mortar Expansion	%	147	0.007	0.014	187	0.010	0.010	100
Mortar Expansion	%	* 132	0.005	0.003	65.8	0.008	0.004	43.1
Mortar Water	mL	142	238	13	5.4	237	13	5.6
Mortar Water	mL	* 140	238	5	2.3	236	6	2.6
Mortar Flow	%	141	110	3	2.9	110	3	3.0
Mortar Flow	%	* 136	110	3	2.5	110	3	2.7

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* ELIMINATED LABS: Data over three S.D. from the mean

FINENESS

Air Permeability 25 70 103 209 39 52 167 2477 3413

45µm Sieve 18 29 47 51 151 156 565 26 42 126 146 265 413 823 2477

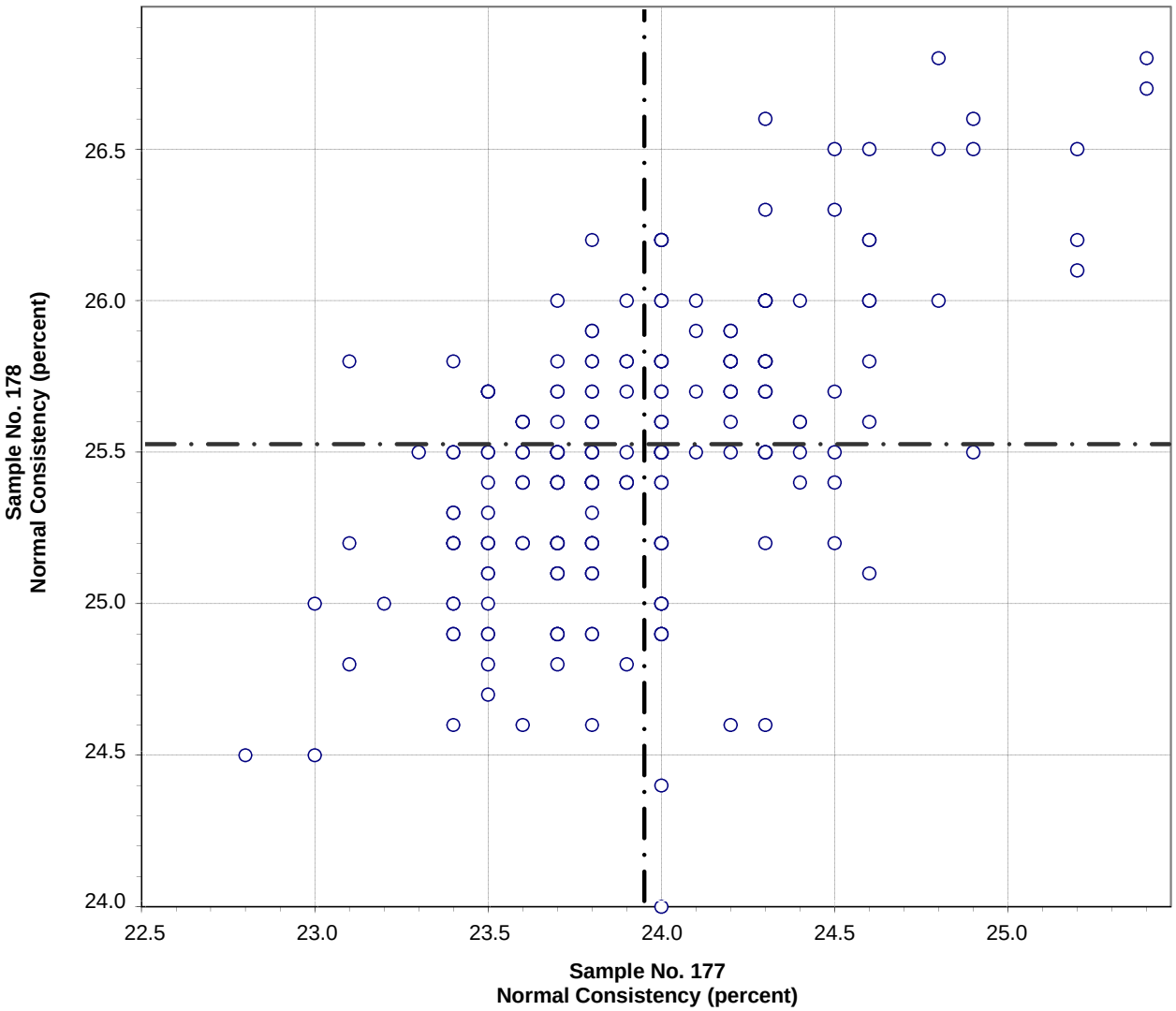
C1038 MORTAR BAR EXPANSION

Mortar Expansion 8 34 134 40 125 169 416 691 779 982 107 146 246 975 2360

Mortar Water 255 3235

Mortar Flow 46 1251 3015 442 694

CCRL Proficiency Sample Program
Normal Consistency - % Water
PORTLAND CEMENT Samples No. 177 and No. 178



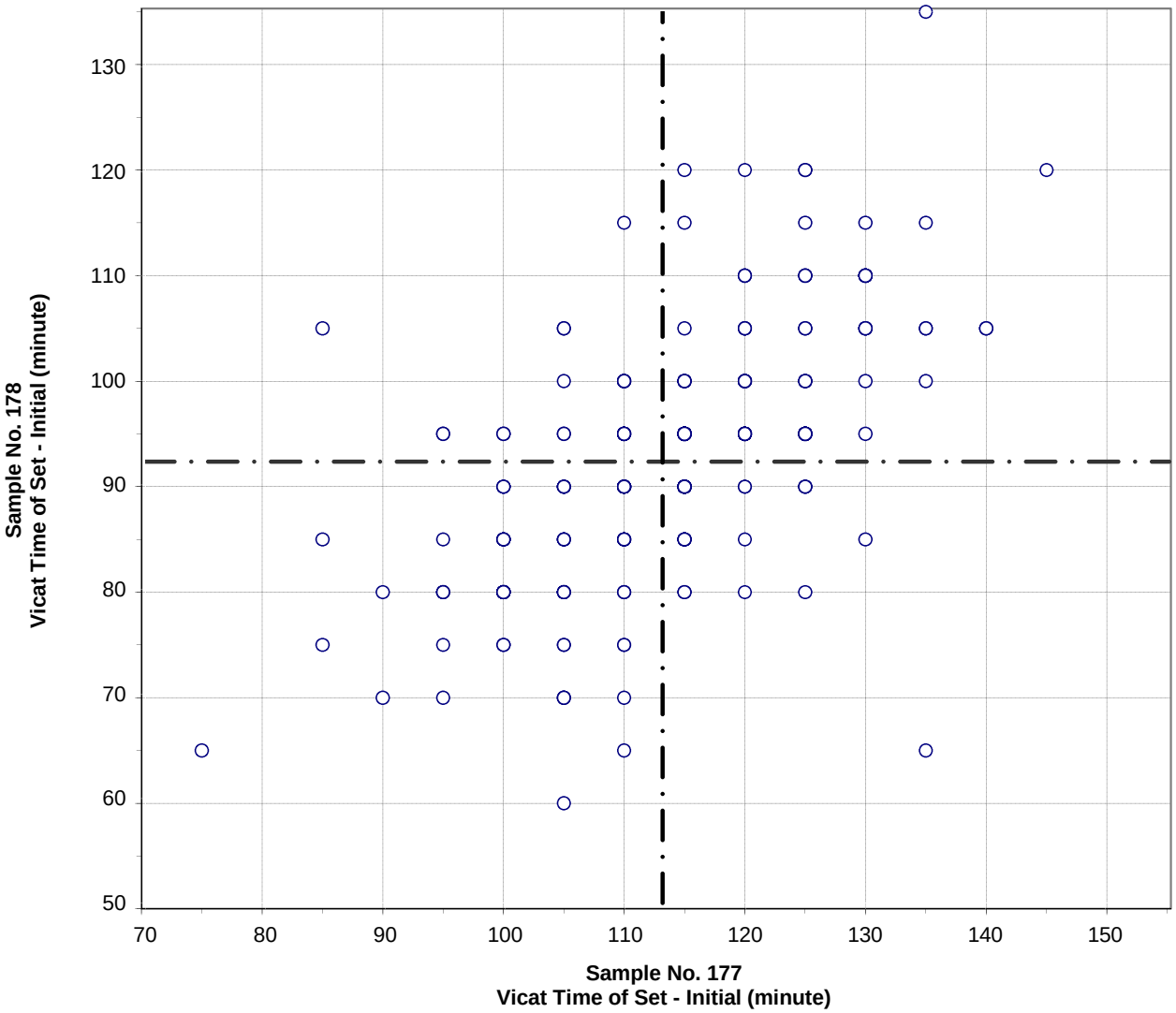
Test No. 110 Normal Consistency - % Water 231 Points

Sample No. 177 Ave 23.9 S.D. 0.4 C.V. 1.9
Sample No. 178 Ave 25.5 S.D. 0.5 C.V. 1.9

Labs eliminated: 3, 169, 255, 3144, 3233

Labs off Diagram: 181, 557, 1483

CCRL Proficiency Sample Program
Vicat Time of Set - Initial
PORTLAND CEMENT Samples No. 177 and No. 178

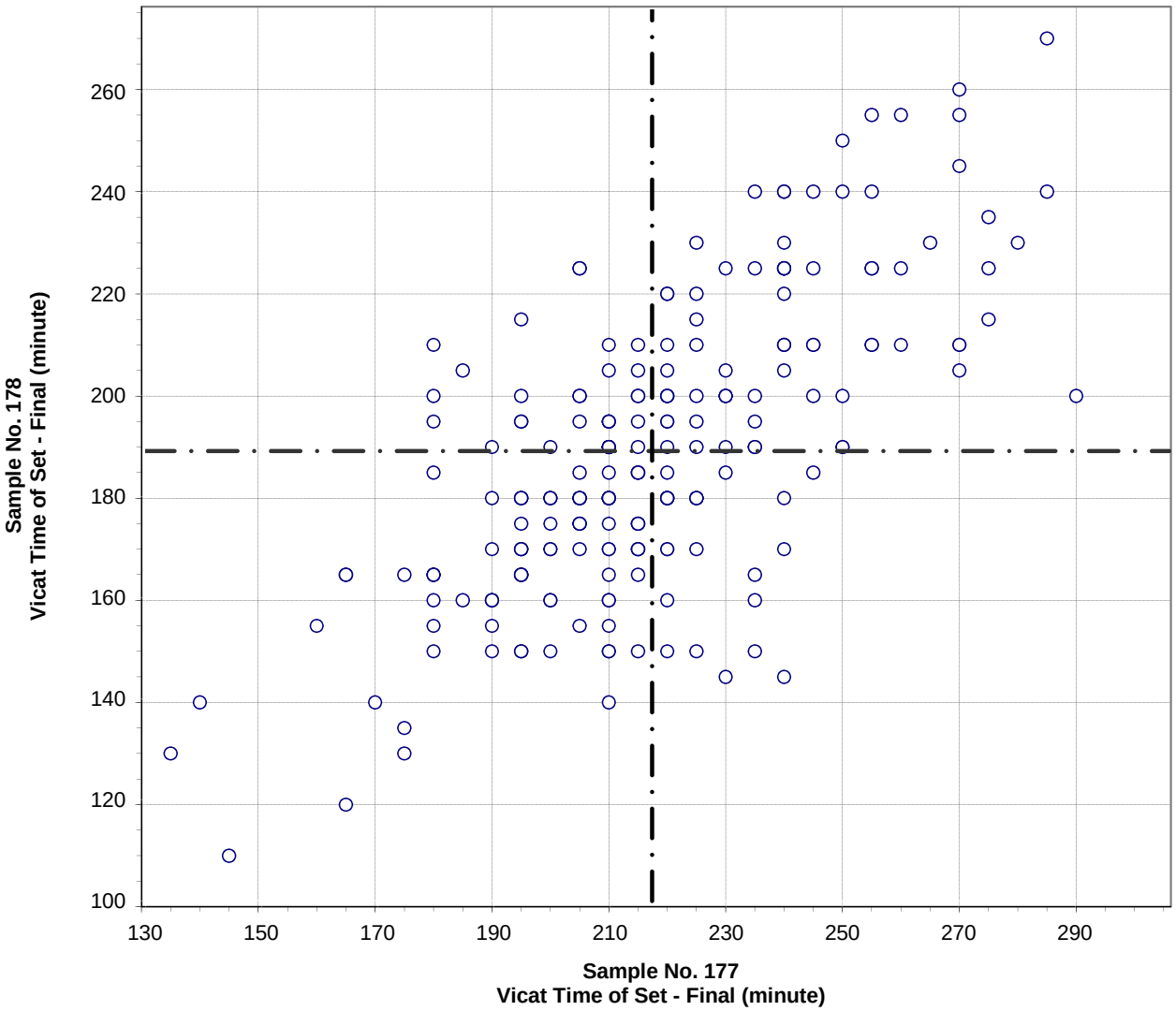


Test No. 120 Vicat Time of Set - Initial 225 Points

Sample No. 177 Ave 113 S.D. 11 C.V. 9.8
Sample No. 178 Ave 92 S.D. 12 C.V. 12.7

Labs eliminated: 4, 69, 95, 176, 360, 440, 1483, 3144

CCRL Proficiency Sample Program
Vicat Time of Set - Final
PORTLAND CEMENT Samples No. 177 and No. 178

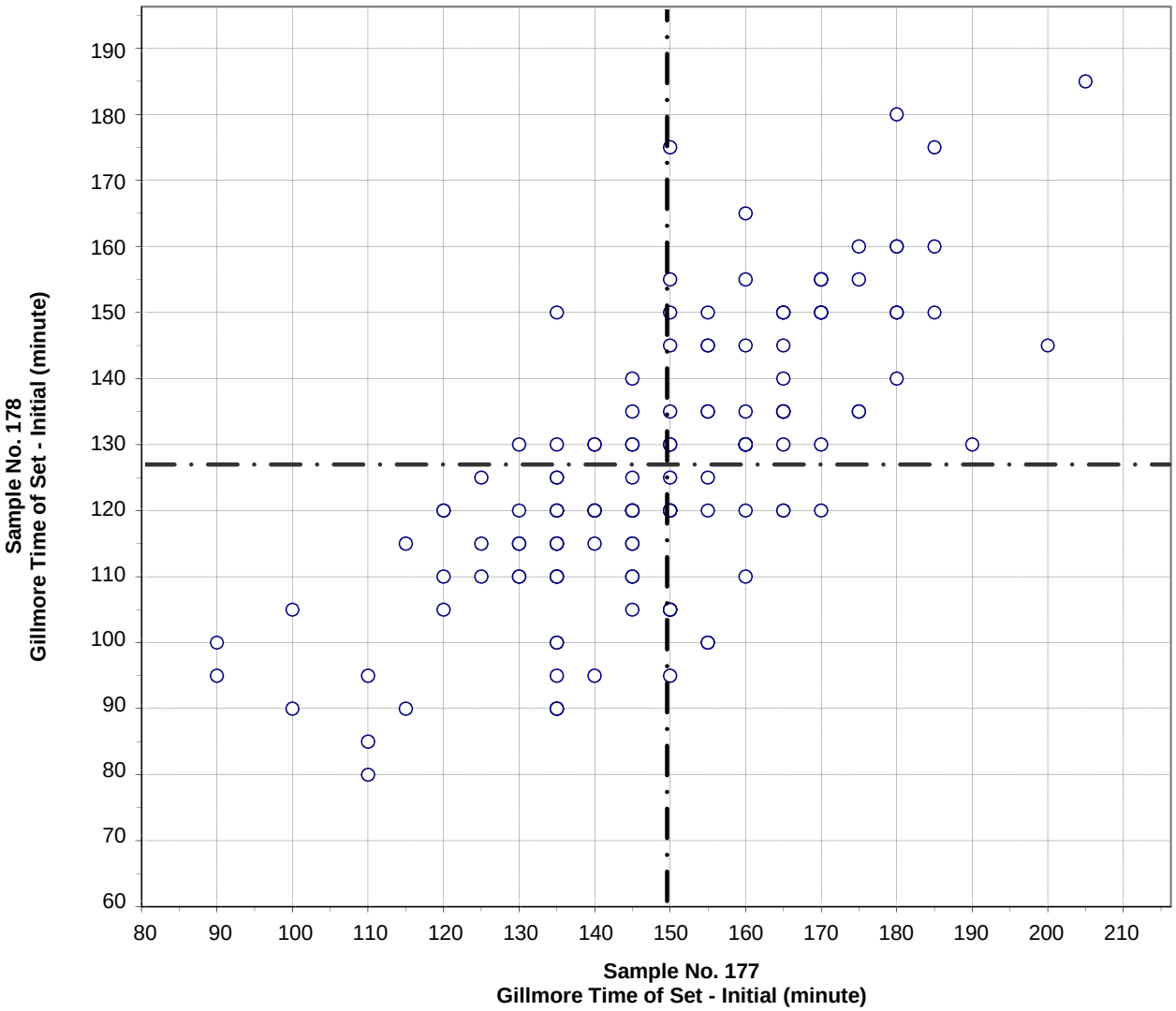


Test No. 121 Vicat Time of Set - Final 222 Points

Sample No. 177	Ave	217	S.D.	27	C.V.	12.3
Sample No. 178	Ave	189	S.D.	28	C.V.	14.9

Labs eliminated: 52, 69, 3144

CCRL Proficiency Sample Program
Gillmore Time of Set - Initial
PORTLAND CEMENT Samples No. 177 and No. 178

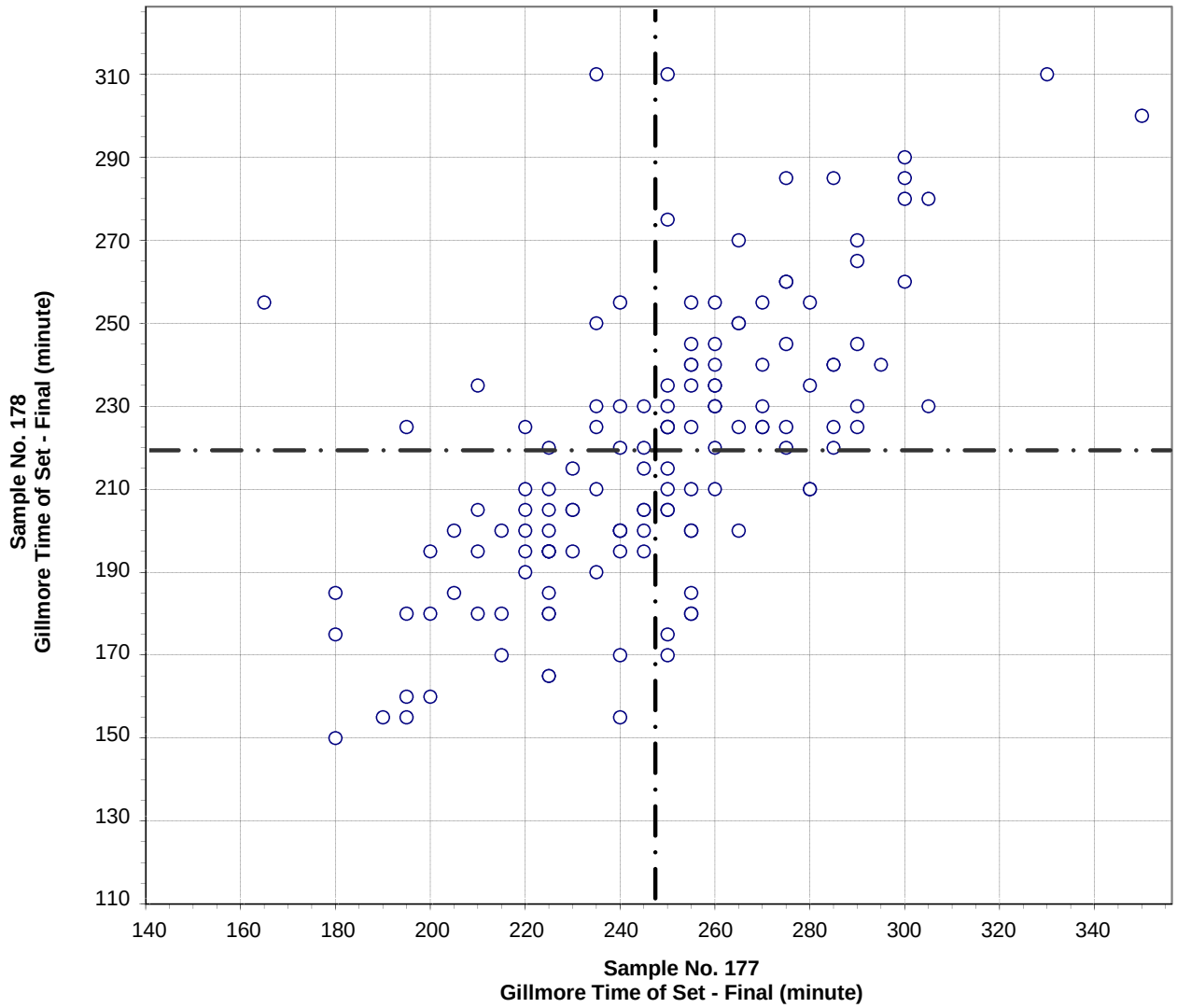


Test No. 130 Gillmore Time of Set - Initial 142 Points

Sample No. 177	Ave	149	S.D.	21	C.V.	13.8
Sample No. 178	Ave	127	S.D.	21	C.V.	16.4

Labs eliminated: 126, 360, 3144

CCRL Proficiency Sample Program
Gillmore Time of Set - Final
PORTLAND CEMENT Samples No. 177 and No. 178

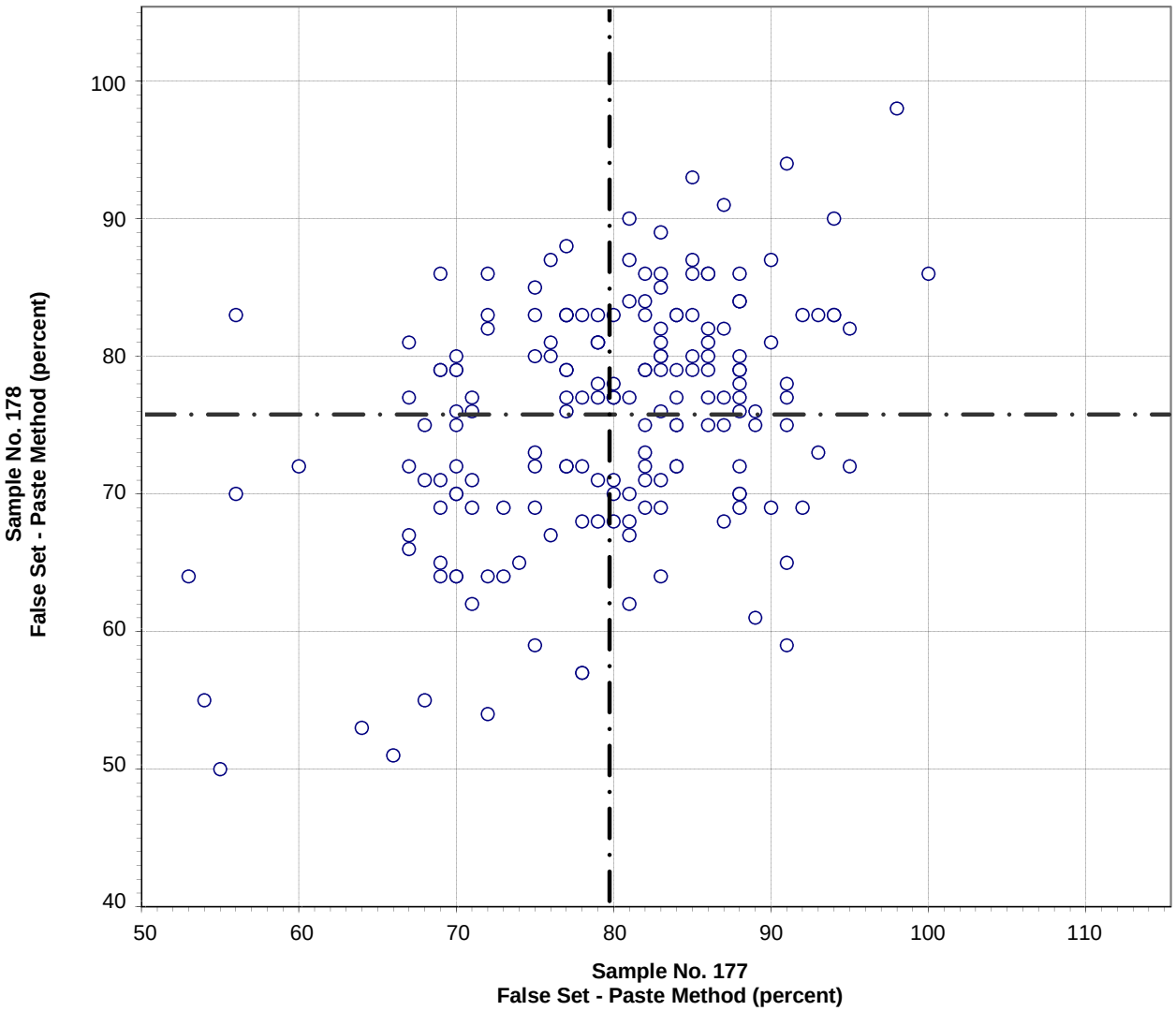


Test No. 140 Gillmore Time of Set - Final 141 Points

Sample No. 177	Ave	247	S.D.	31	C.V.	12.6
Sample No. 178	Ave	219	S.D.	34	C.V.	15.6

Labs eliminated: 52, 126, 3144

CCRL Proficiency Sample Program
False Set - Paste Method
PORTLAND CEMENT Samples No. 177 and No. 178

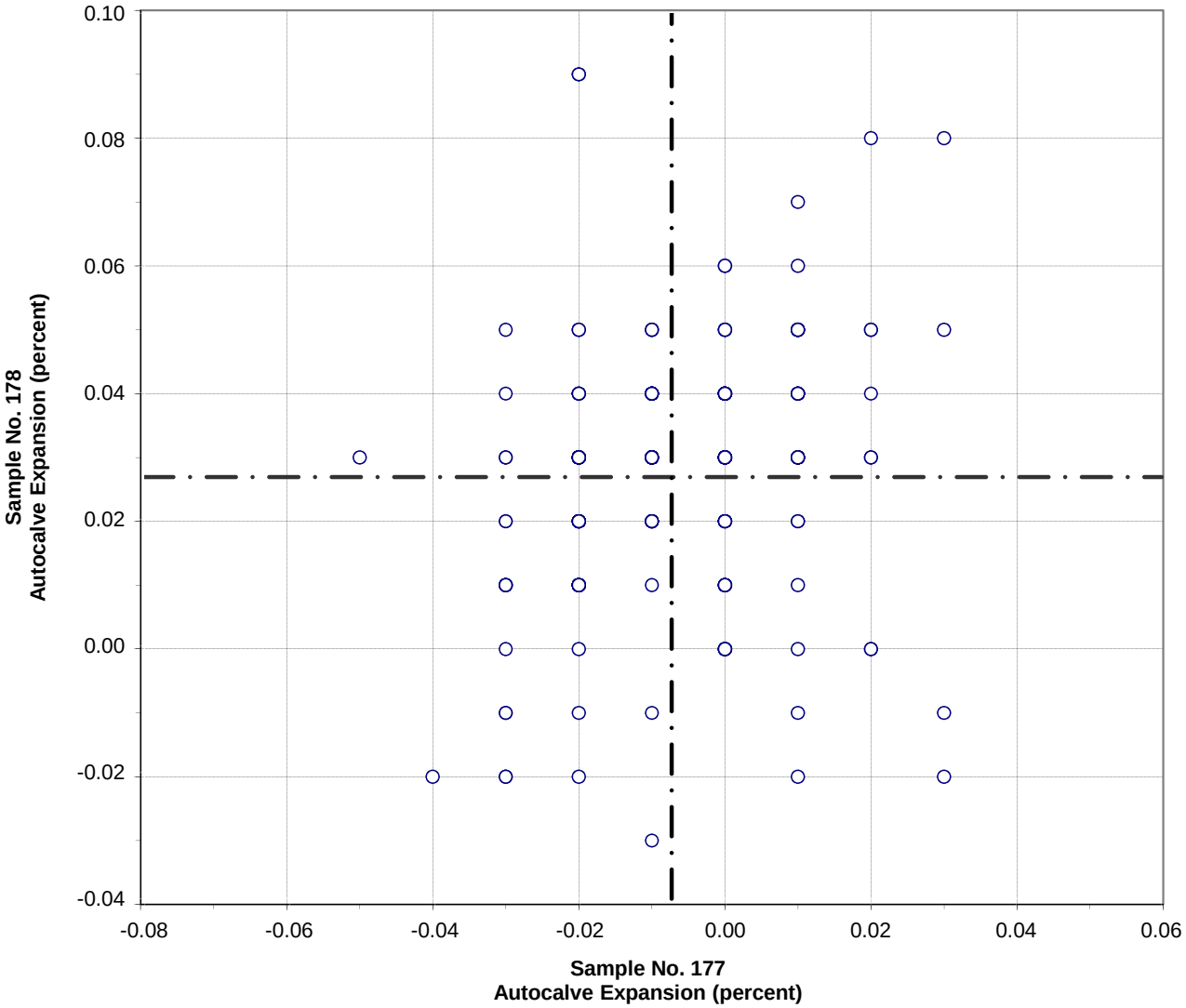


Test No. 150 False Set - Paste Method 183 Points

Sample No. 177	Ave	80	S.D.	8.7	C.V. 10.9
Sample No. 178	Ave	76	S.D.	8.6	C.V. 11.4

Labs eliminated: 126, 162

CCRL Proficiency Sample Program
Autoclave Expansion
PORTLAND CEMENT Samples No. 177 and No. 178

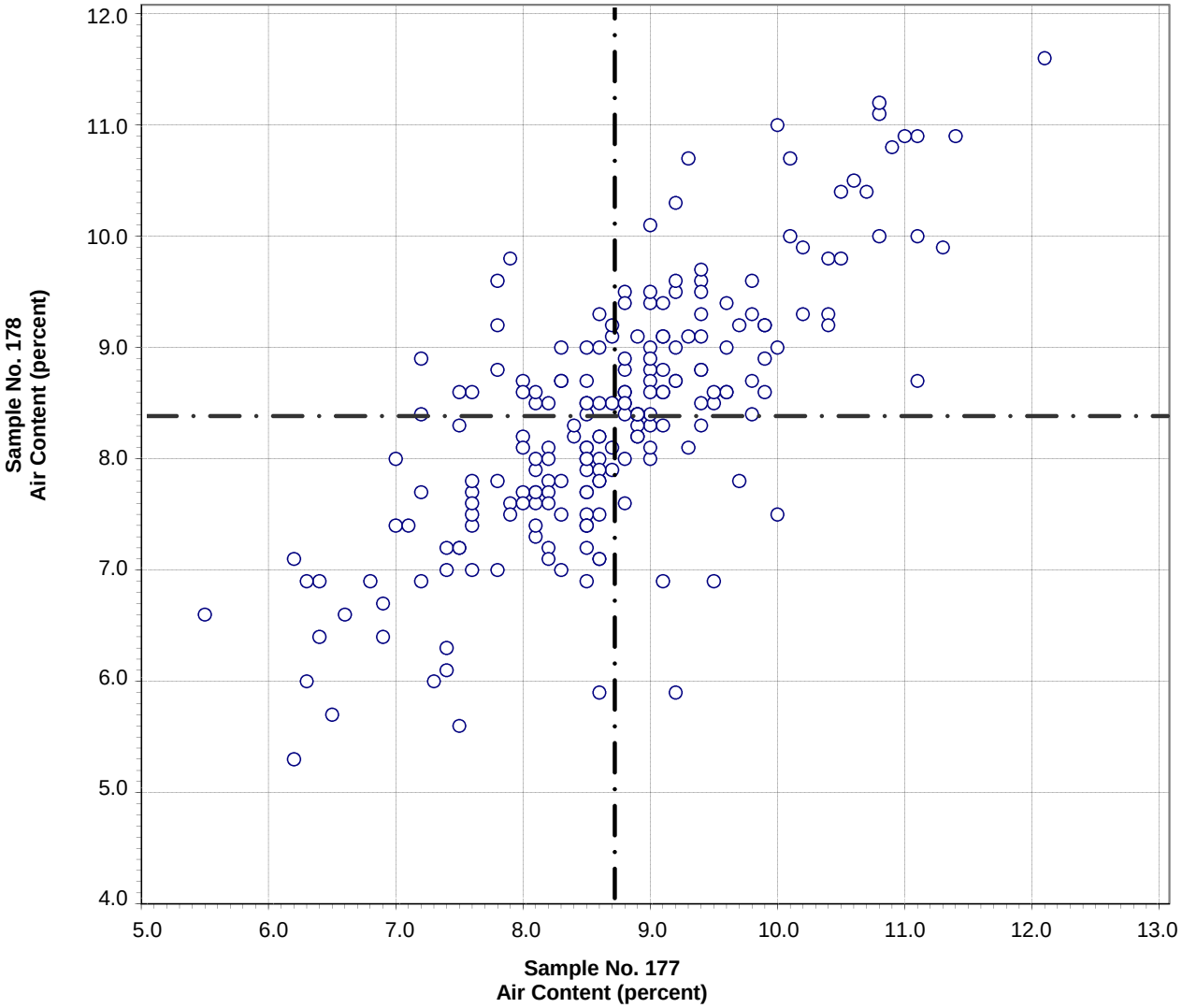


Test No. 160 Autoclave Expansion 212 Points

Sample No. 177 Ave -0.01 S.D. 0.01 C.V. 190
Sample No. 178 Ave 0.03 S.D. 0.02 C.V. 72

Labs eliminated: 95, 105, 309, 354, 25, 975, 1435, 1940, 2464, 3057

CCRL Proficiency Sample Program
Air Content %
PORTLAND CEMENT Samples No. 177 and No. 178

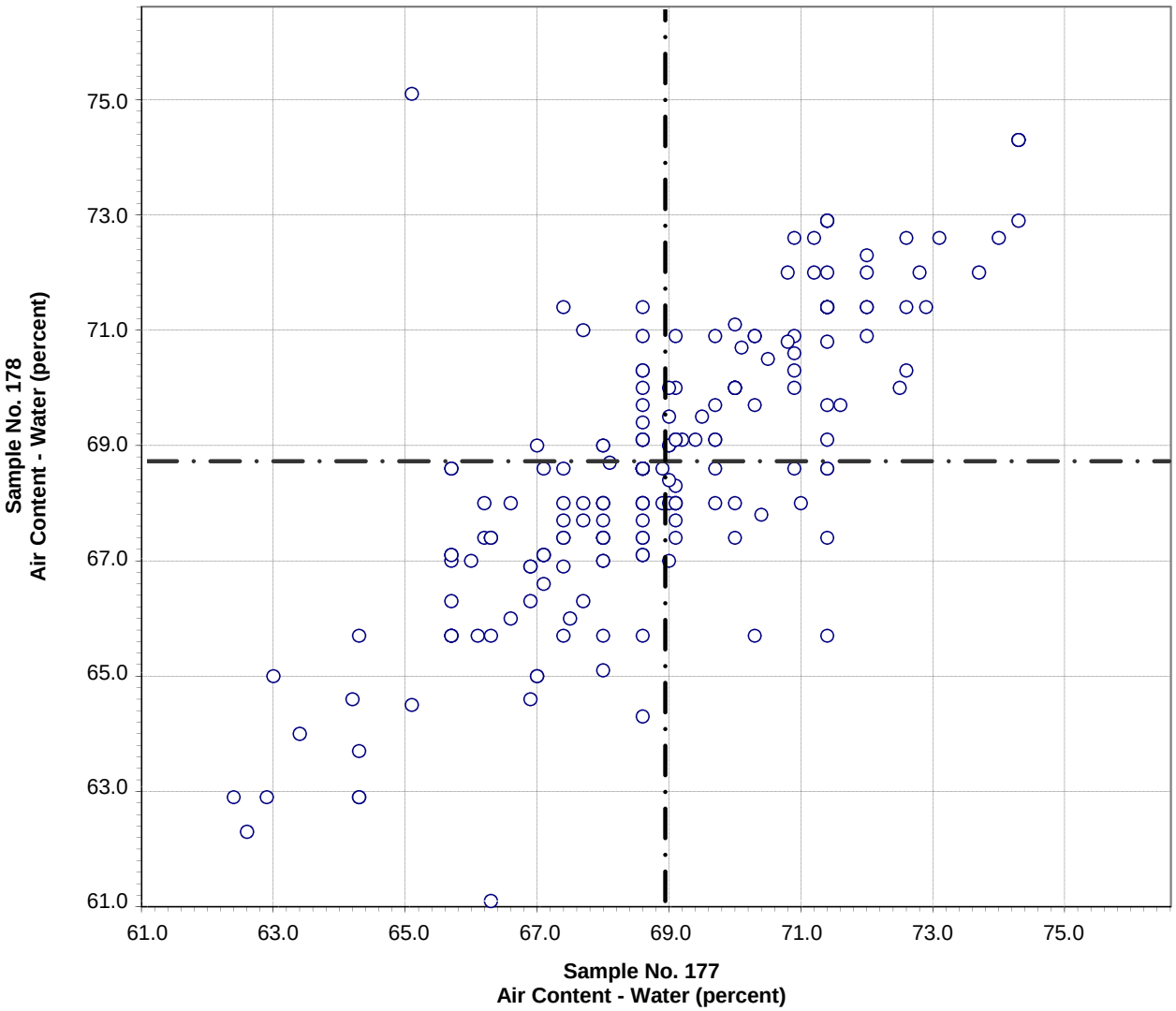


Test No. 170 Air Content % 210 Points

Sample No. 177	Ave	8.7	S.D.	1.1	C.V. 12.6
Sample No. 178	Ave	8.4	S.D.	1.1	C.V. 13.7

Labs eliminated: 25, 56, 416, 1435, 1657, 2490

CCRL Proficiency Sample Program
Air Content - % Water
PORTLAND CEMENT Samples No. 177 and No. 178

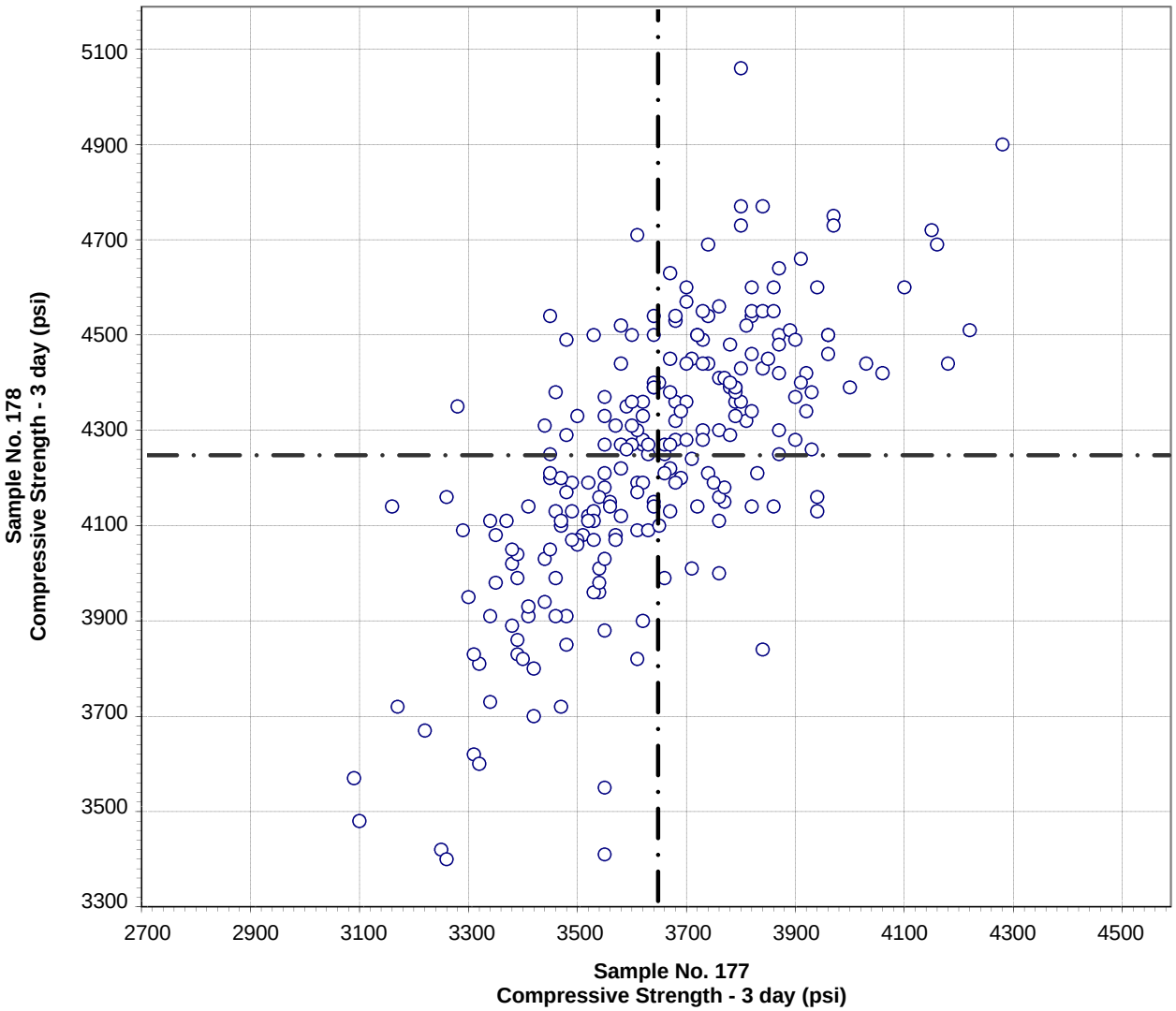


Test No. 180 Air Content - % Water 199 Points

Sample No. 177	Ave	68.9	S.D.	2.4	C.V. 3.4
Sample No. 178	Ave	68.7	S.D.	2.5	C.V. 3.6

Labs eliminated: 18, 66, 162, 289, 126, 408, 694, 982, 80, 360, 1435, 2464, 3144

CCRL Proficiency Sample Program
Compressive Strength - 3 day
PORTLAND CEMENT Samples No. 177 and No. 178



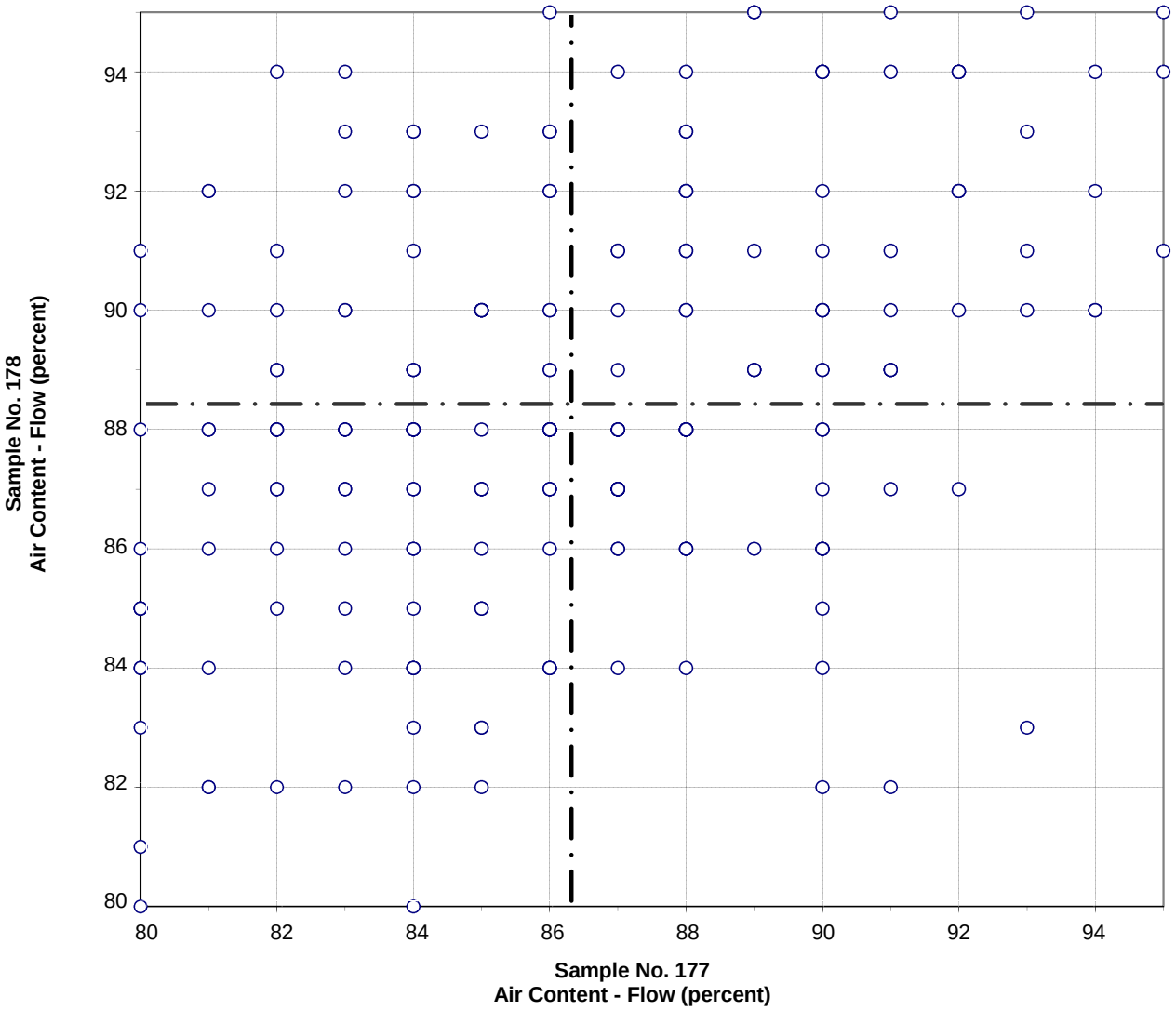
Test No. 200 Compressive Strength - 3 day 236 Points

Sample No. 177	Ave	3644	S.D.	214	C.V.	5.9
Sample No. 178	Ave	4245	S.D.	299	C.V.	7.0

Labs eliminated: 14, 18, 48, 1773, 3511

Labs off Diagram: 52, 691, 2466

CCRL Proficiency Sample Program
Air Content - Flow
PORTLAND CEMENT Samples No. 177 and No. 178

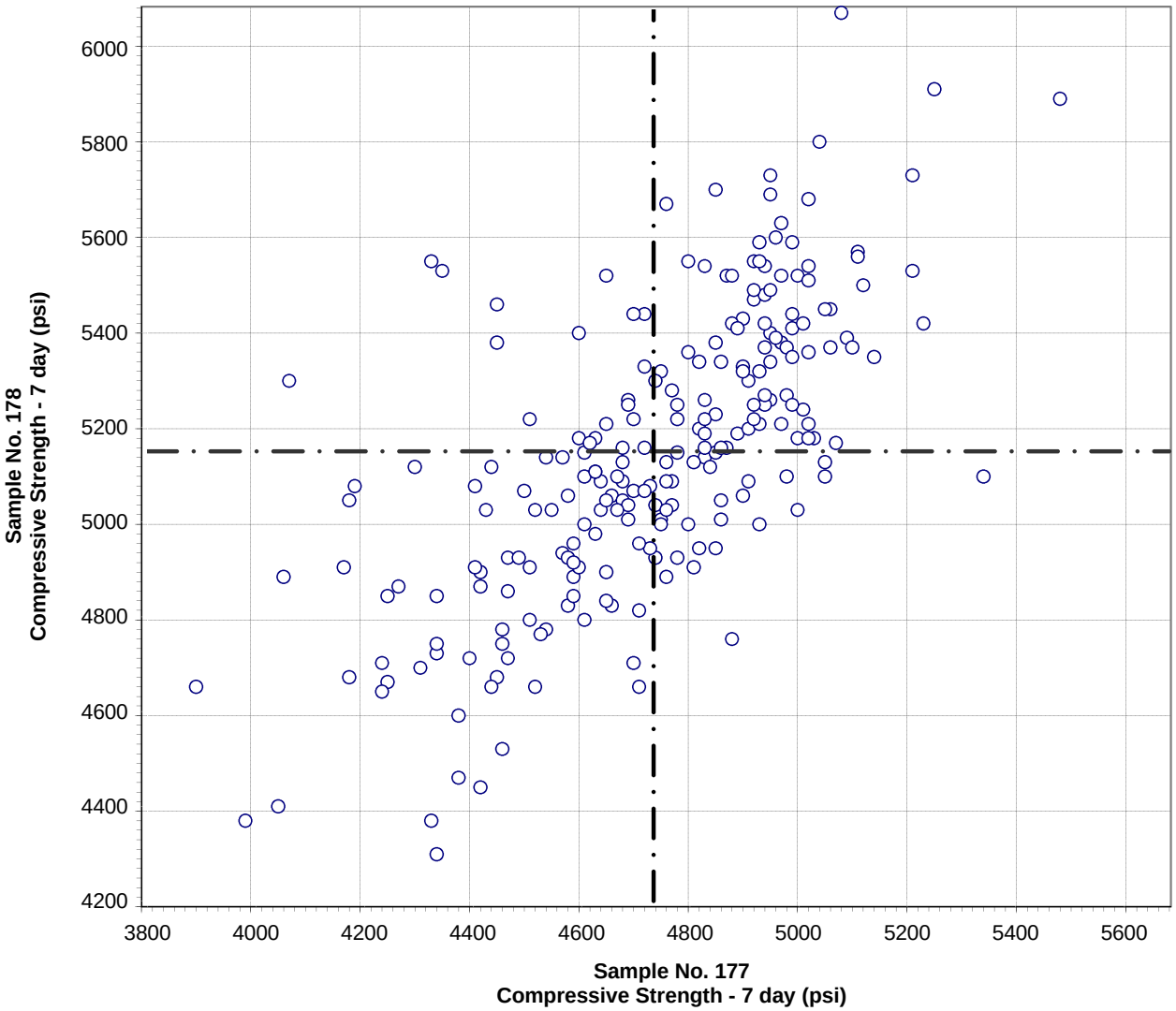


Test No. 190 Air Content - Flow 212 Points

Sample No. 177	Ave	86	S.D.	3.7	C.V.	4.3
Sample No. 178	Ave	88	S.D.	3.4	C.V.	3.8

Labs eliminated: 252, 3015

CCRL Proficiency Sample Program
Compressive Strength - 7 day
PORTLAND CEMENT Samples No. 177 and No. 178

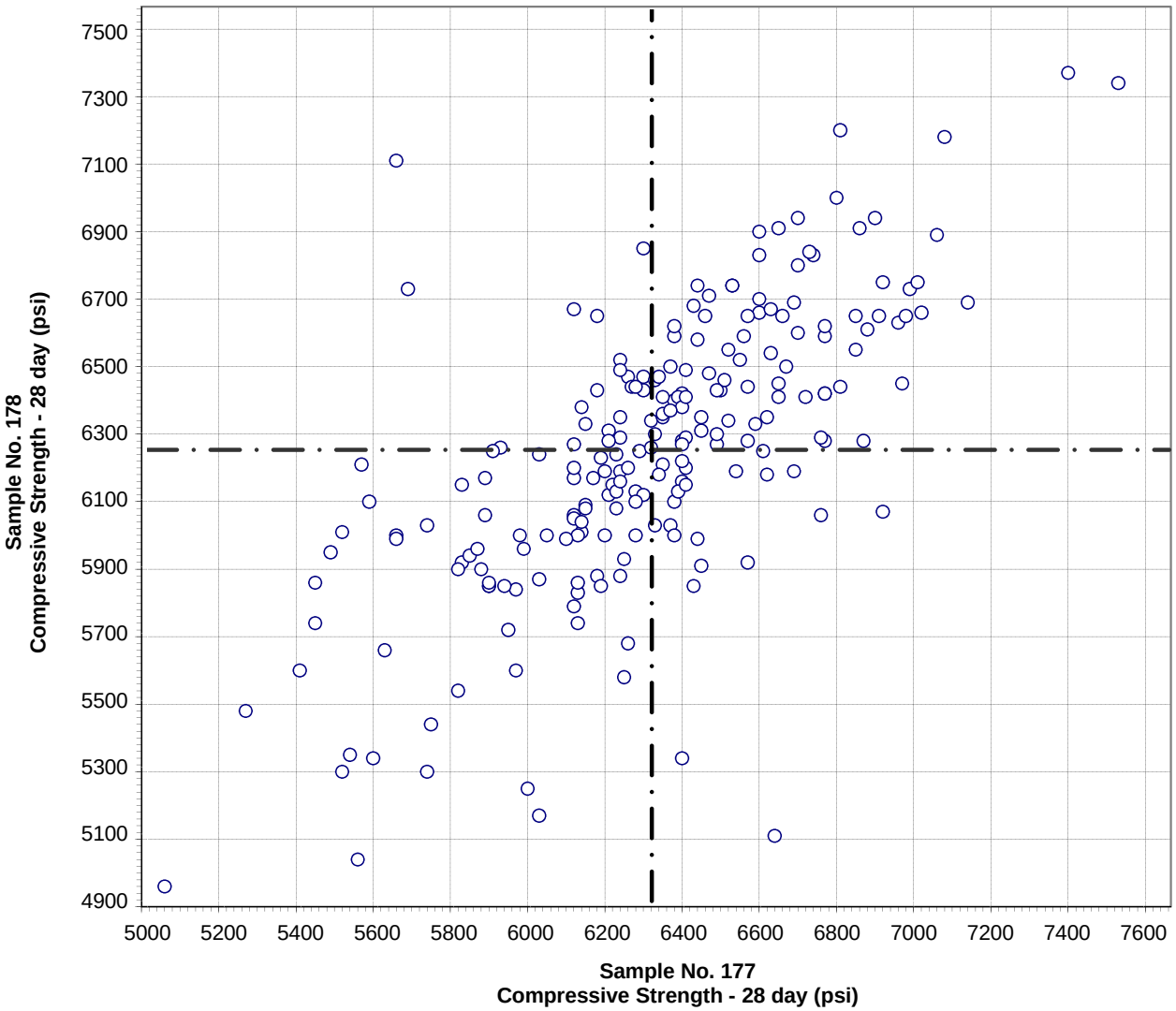


Test No. 210 Compressive Strength - 7 day 232 Points

Sample No. 177	Ave	4733	S.D.	265	C.V. 5.6
Sample No. 178	Ave	5150	S.D.	303	C.V. 5.9

Labs eliminated: 14, 416, 1773, 37, 49, 52, 1435, 1956, 3511

CCRL Proficiency Sample Program
Compressive Strength - 28 day
PORTLAND CEMENT Samples No. 177 and No. 178



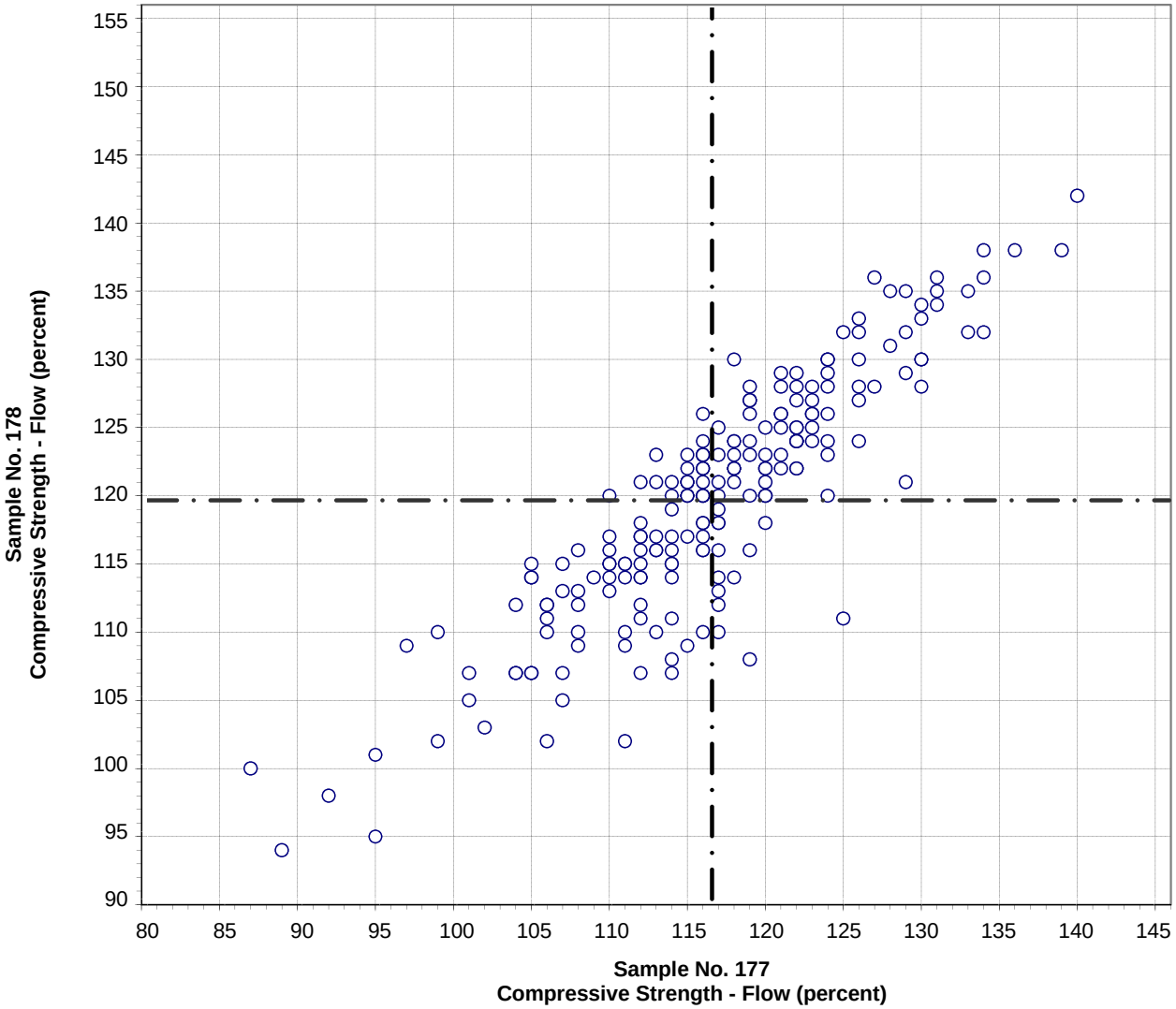
Test No. 211 Compressive Strength - 28 day 215 Points

Sample No. 177	Ave	6316	S.D.	407	C.V.	6.4
Sample No. 178	Ave	6250	S.D.	420	C.V.	6.7

Labs eliminated: 9, 14, 24, 84, 1773

Labs off Diagram: 17

CCRL Proficiency Sample Program
Compressive Strength - Flow
PORTLAND CEMENT Samples No. 177 and No. 178



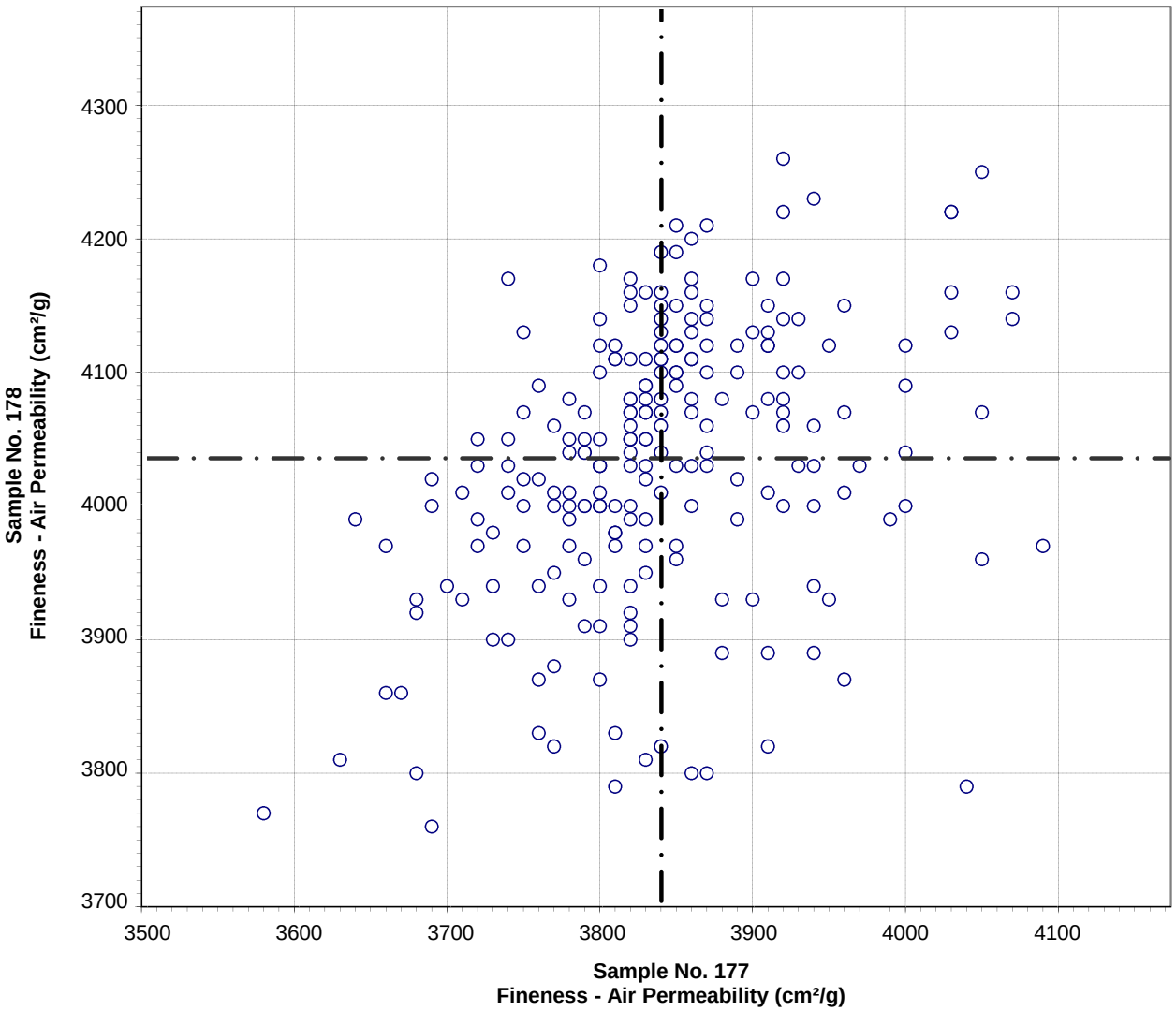
Test No. 230 Compressive Strength - Flow 209 Points

Sample No. 177 Ave 116 S.D. 9 C.V. 7.6
Sample No. 178 Ave 120 S.D. 9 C.V. 7.6

Labs eliminated: 18, 1483, 2477, 3511

Labs off Diagram: 180

CCRL Proficiency Sample Program
Fineness - Air Permeability
PORTLAND CEMENT Samples No. 177 and No. 178

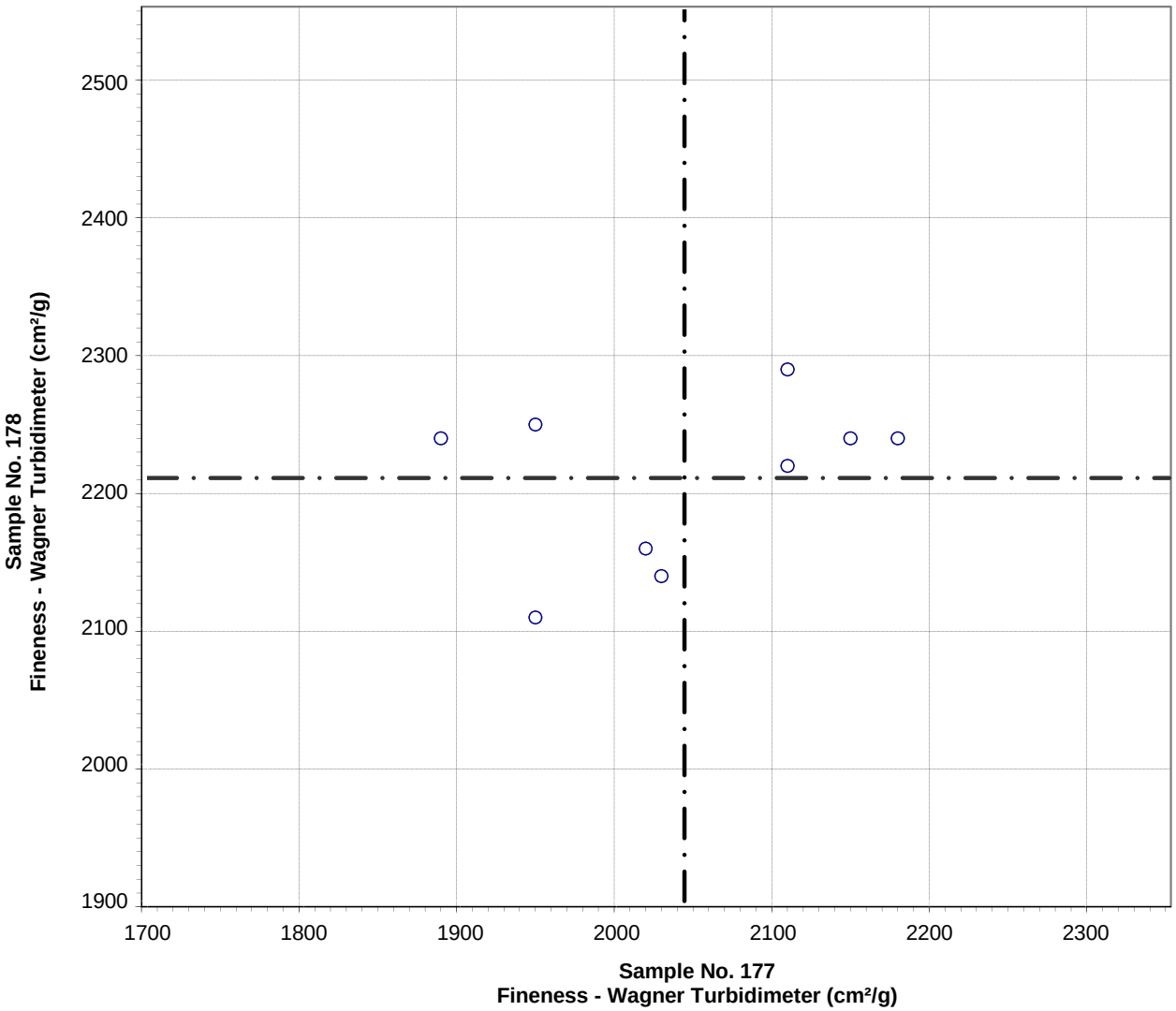


Test No. 270 Fineness - Air Permeability 227 Points

Sample No. 177 Ave 3839 S.D. 87 C.V. 2.3
Sample No. 178 Ave 4035 S.D. 102 C.V. 2.5

Labs eliminated: 25, 70, 103, 209, 39, 52, 167, 2477, 3413

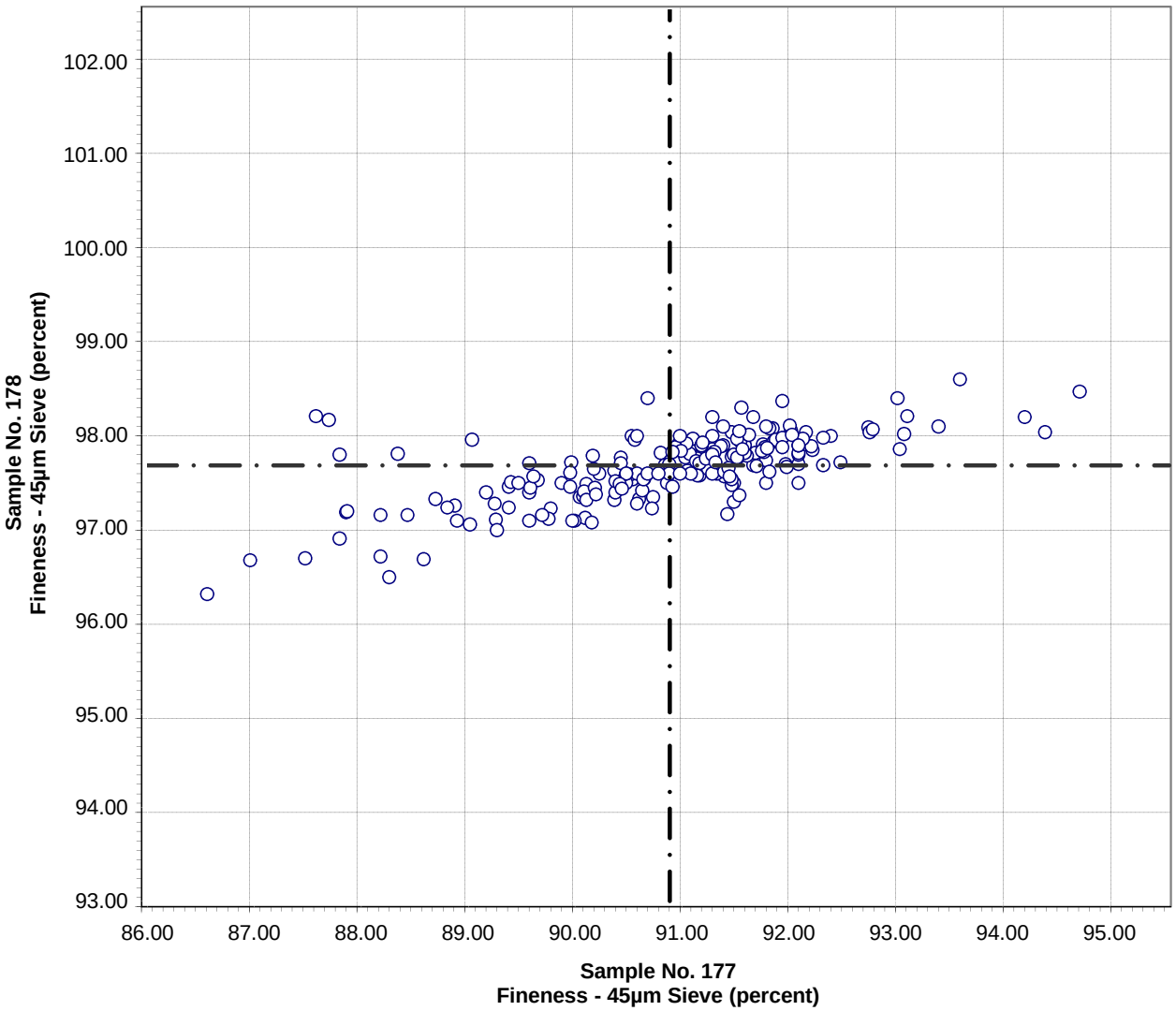
CCRL Proficiency Sample Program
Fineness - Wagner Turbidimeter
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 280 Fineness - Wagner Turbidimeter 9 Points

Sample No. 177	Ave	2043	S.D.	100	C.V.	4.9
Sample No. 178	Ave	2210	S.D.	59	C.V.	2.7

CCRL Proficiency Sample Program
Fineness - 45µm Sieve
PORTLAND CEMENT Samples No. 177 and No. 178

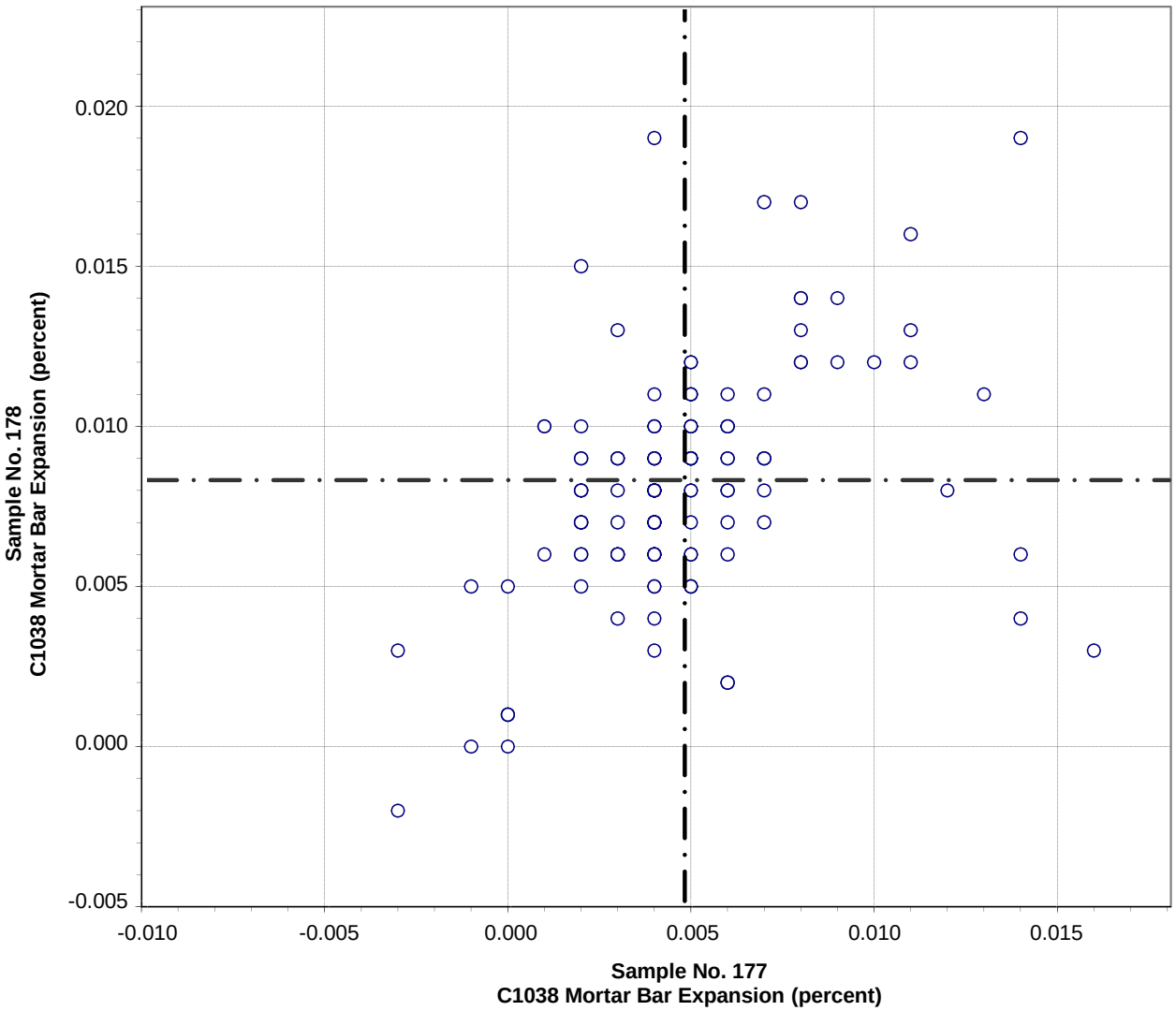


Test No. 281 Fineness - 45µm Sieve 209 Points

Sample No. 177 Ave 90.89 S.D. 1.31 C.V. 1.4
Sample No. 178 Ave 97.67 S.D. 0.36 C.V. 0.4

Labs eliminated: 18, 29, 47, 51, 151, 156, 565, 26, 42, 126, 146, 265, 413, 823, 2477

CCRL Proficiency Sample Program
C1038 Mortar Bar Expansion
PORTLAND CEMENT Samples No. 177 and No. 178

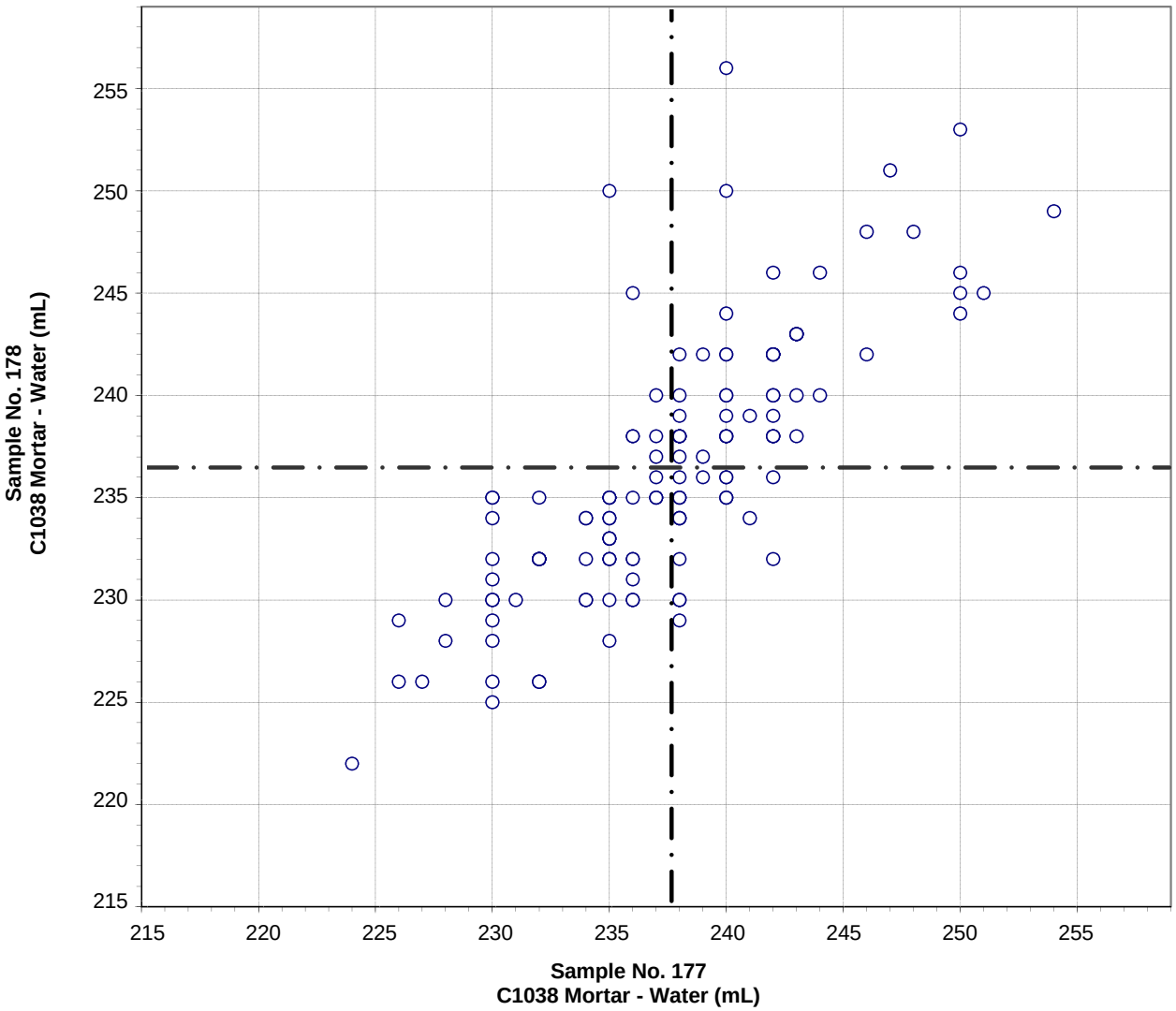


Test No. 400 C1038 Mortar Bar Expansion 132 Points

Sample No. 177	Ave	0.005	S.D.	0.003	C.V.	65.8
Sample No. 178	Ave	0.008	S.D.	0.004	C.V.	43.1

Labs eliminated: 8, 34, 134, 40, 125, 169, 416, 691, 779, 982, 107, 146, 246, 975, 2360

CCRL Proficiency Sample Program
C1038 Mortar - Water
PORTLAND CEMENT Samples No. 177 and No. 178

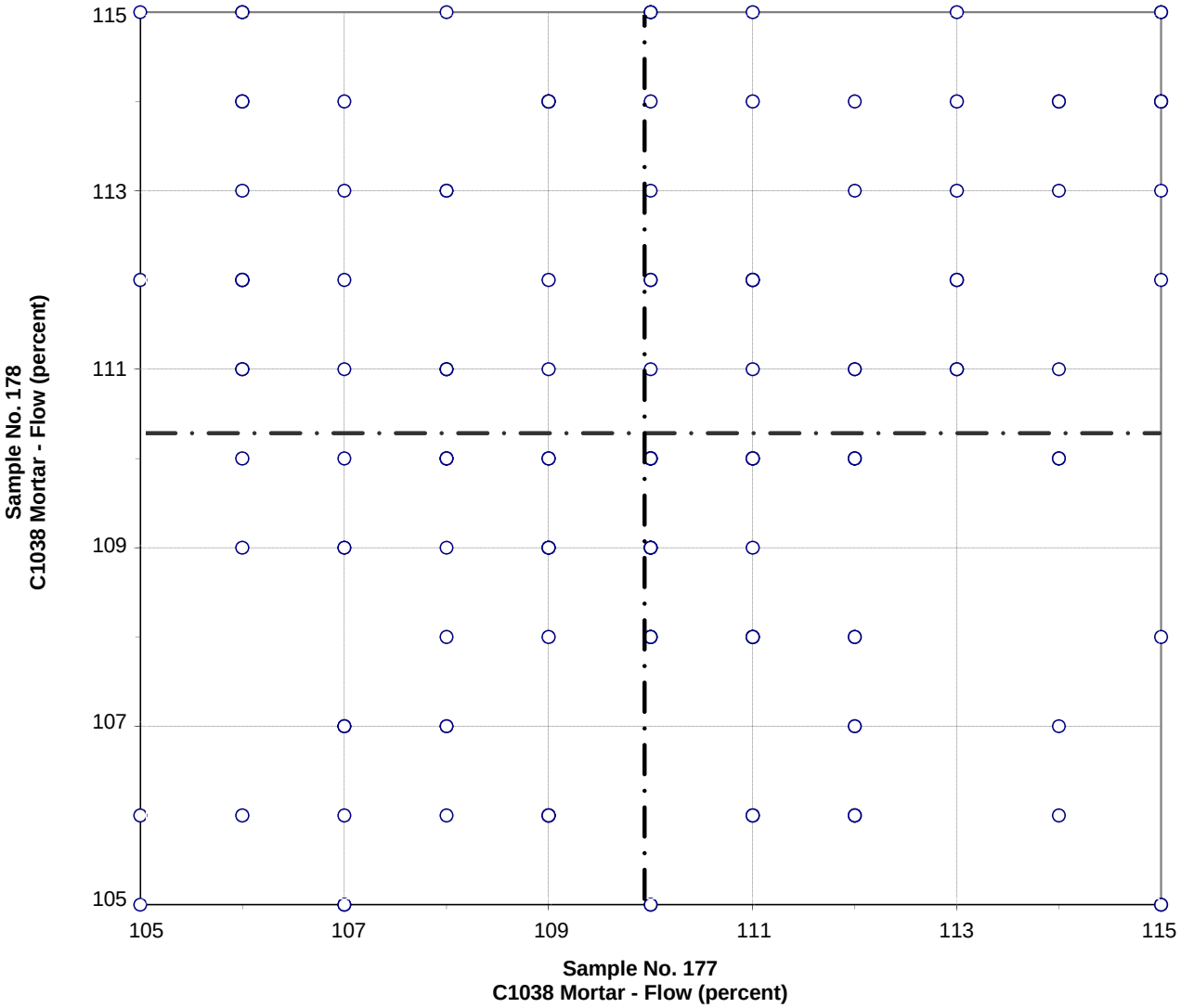


Test No. 401 C1038 Mortar - Water 140 Points

Sample No. 177	Ave	238	S.D.	5	C.V. 2.3
Sample No. 178	Ave	236	S.D.	6	C.V. 2.6

Labs eliminated: 255, 3235

CCRL Proficiency Sample Program
C1038 Mortar - Flow
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 402 C1038 Mortar - Flow 136 Points

Sample No. 177	Ave	110	S.D.	3	C.V. 2.5
Sample No. 178	Ave	110	S.D.	3	C.V. 2.7

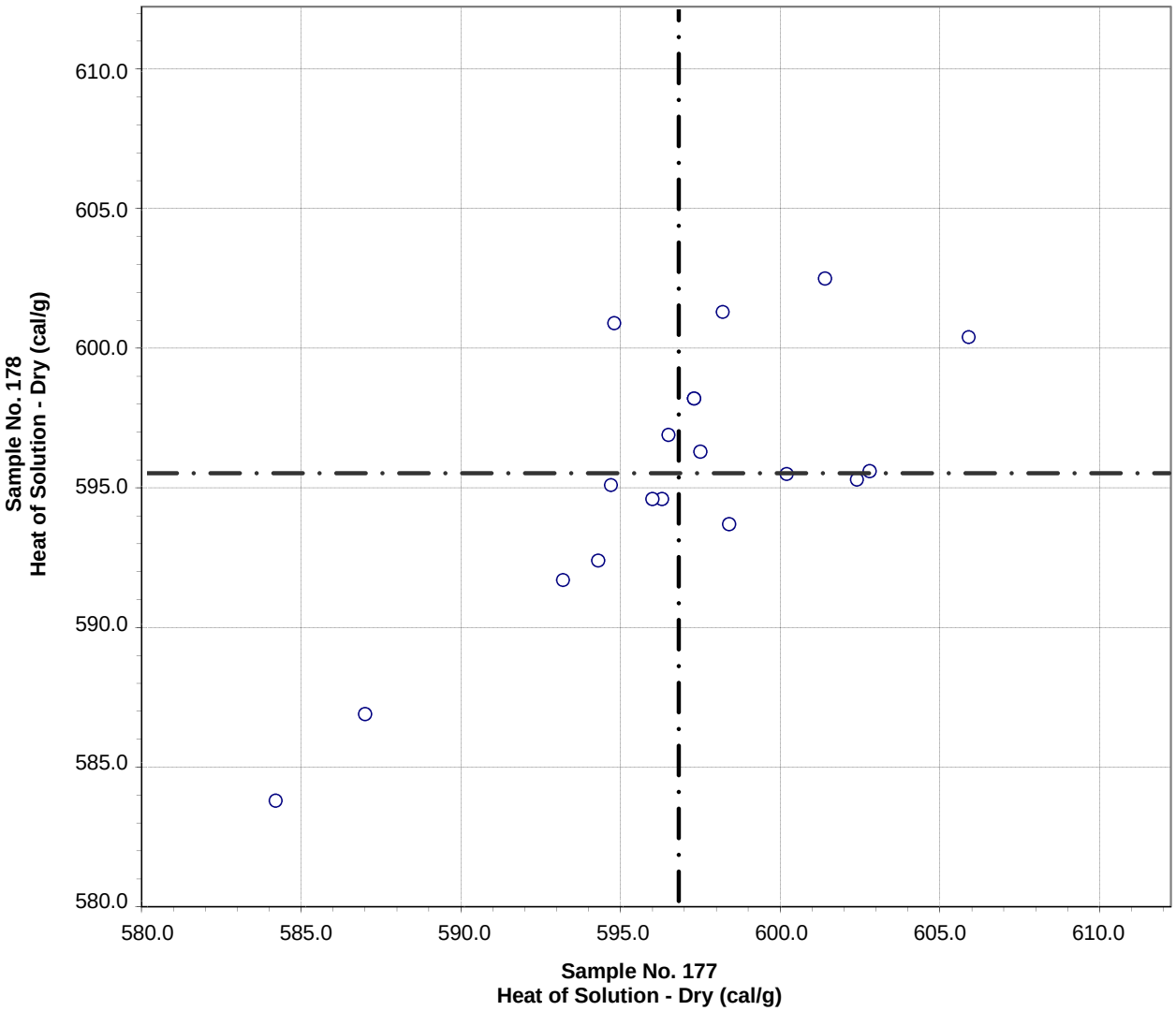
Labs eliminated: 46, 1251, 3015, 442, 694

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 177 and No. 178
Final Report - Heat of Hydration Results
September 10, 2010

SUMMARY OF RESULTS

			Sample No. 177			Sample No. 178		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
C186 HEAT OF HYDRATION								
Heat Solution, Dry	cal/g	19	596.8	5.1	0.9	595.5	4.7	0.8
Heat Sol, 7 day	cal/g	19	518.5	5.0	1.0	511.0	5.9	1.2
Heat Sol, 28 day	cal/g	15	507.1	4.5	0.9	501.1	4.4	0.9
Heat Hyd, 7 day	cal/g	21	79.0	3.9	4.9	85.0	4.3	5.1
Heat Hyd, 28 day	cal/g	17	90.0	2.9	3.2	95.7	3.5	3.6
C1702 HEAT OF HYDRATION USING ISOTHERMAL CONDUCTION CALORIMETRY								
Heat Hyd, 3 day	J/g	3	281	6	2.2	318	2	0.5
Heat Hyd, 7 day	J/g	4	276	122	44	298	130	44

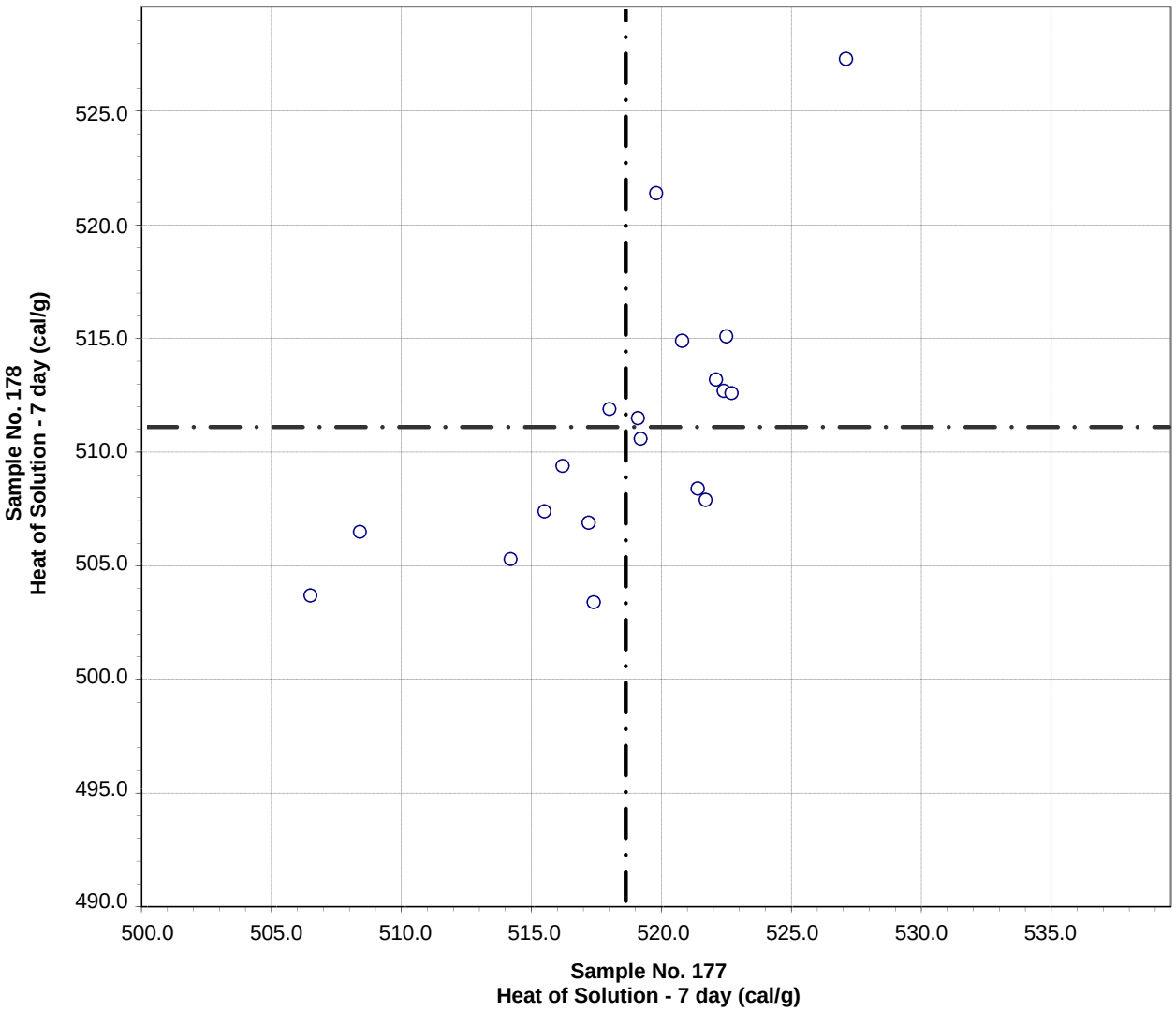
CCRL Proficiency Sample Program
C186 Heat of Solution - Dry
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 291 C186 Heat of Solution - Dry 19 Points

Sample No. 177	Ave	596.8	S.D.	5.1	C.V.	0.9
Sample No. 178	Ave	595.5	S.D.	4.7	C.V.	0.8

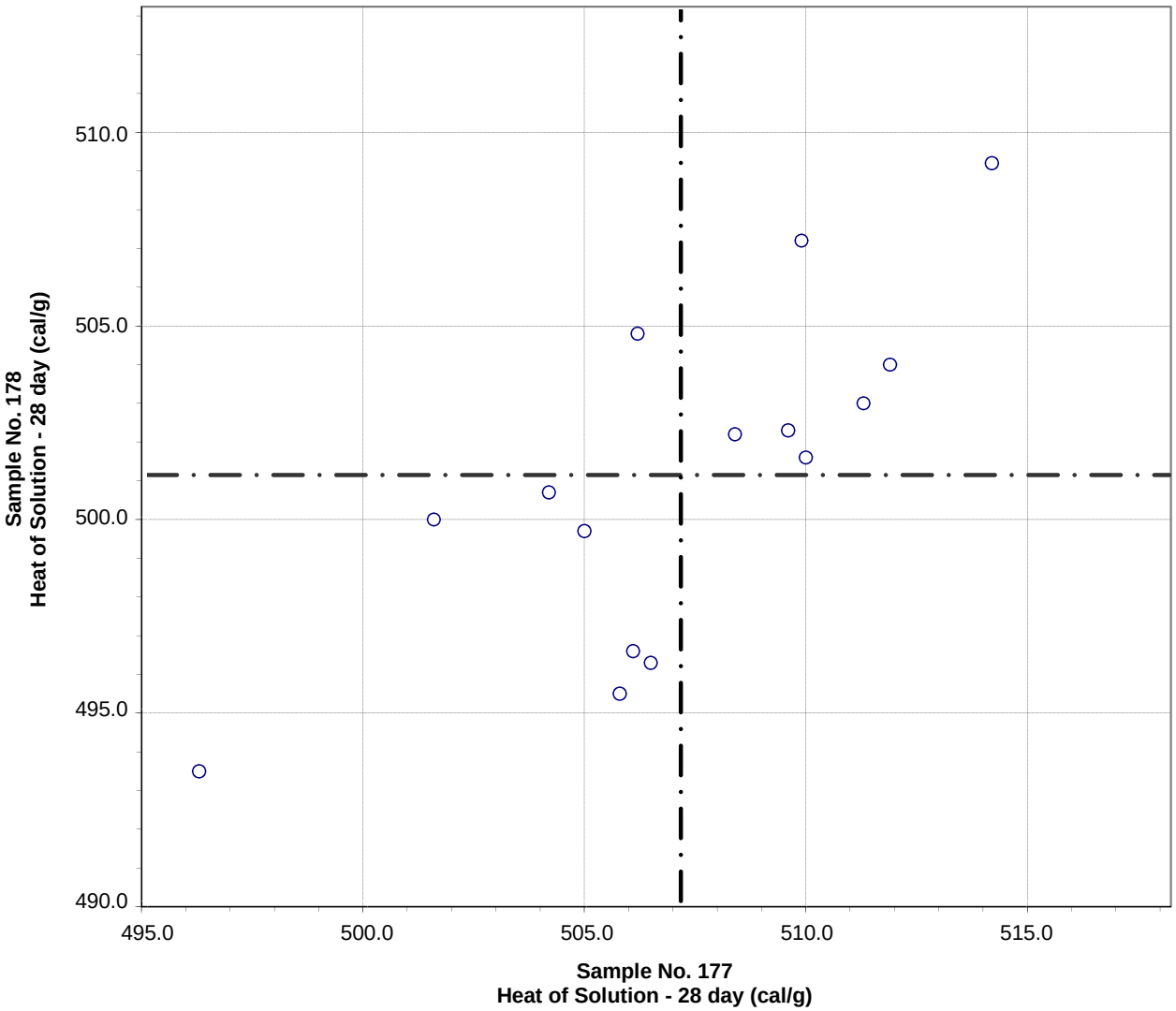
CCRL Proficiency Sample Program
C186 Heat of Solution - 7 day
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 292 C186 Heat of Solution - 7 day 19 Points

Sample No. 177	Ave	518.5	S.D.	5.0	C.V.	1.0
Sample No. 178	Ave	511.1	S.D.	5.9	C.V.	1.2

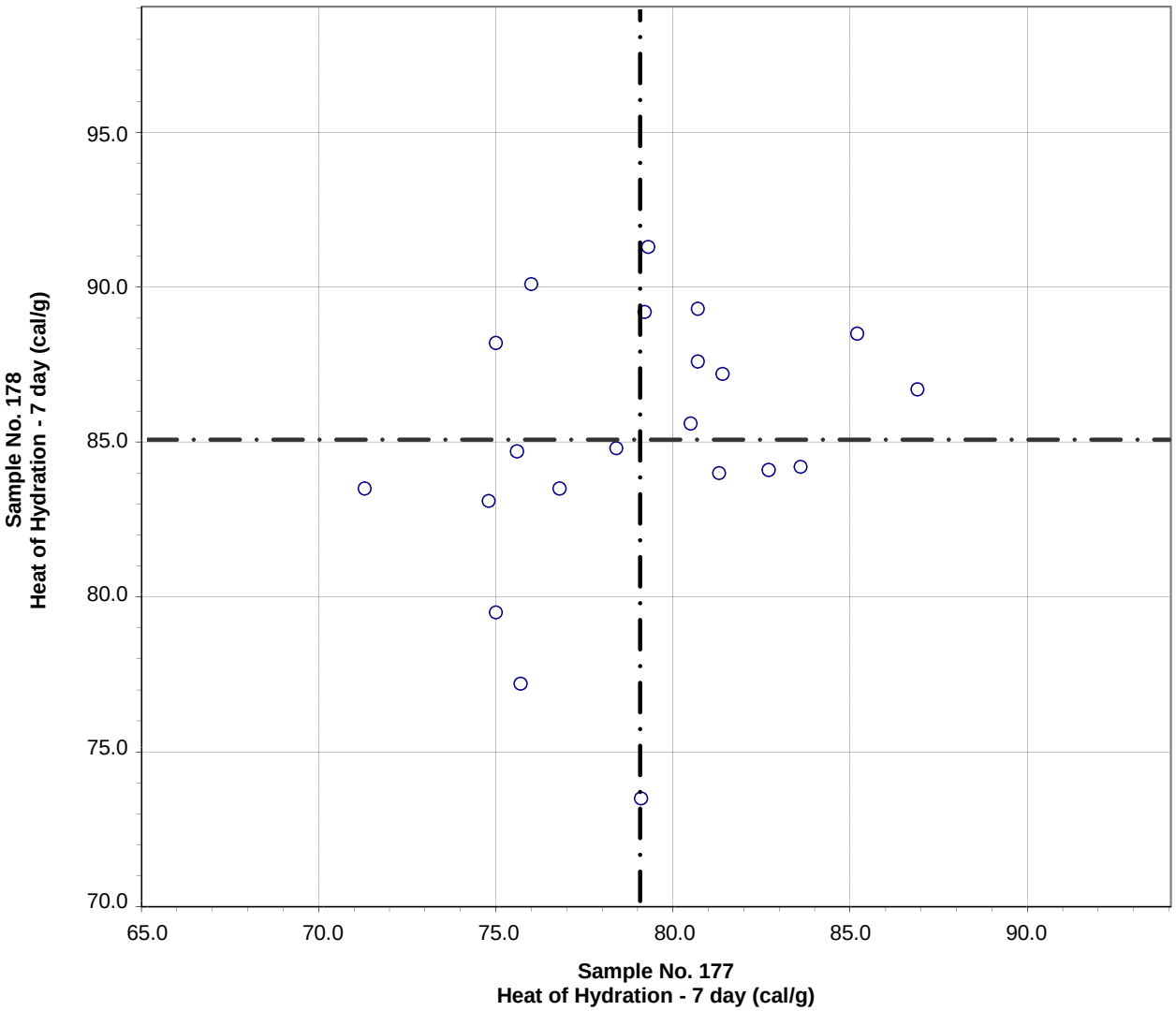
CCRL Proficiency Sample Program
C186 Heat of Solution - 28 day
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 301 C186 Heat of Solution - 28 day 15 Points

Sample No. 177	Ave	507.1	S.D.	4.5	C.V.	0.9
Sample No. 178	Ave	501.1	S.D.	4.4	C.V.	0.9

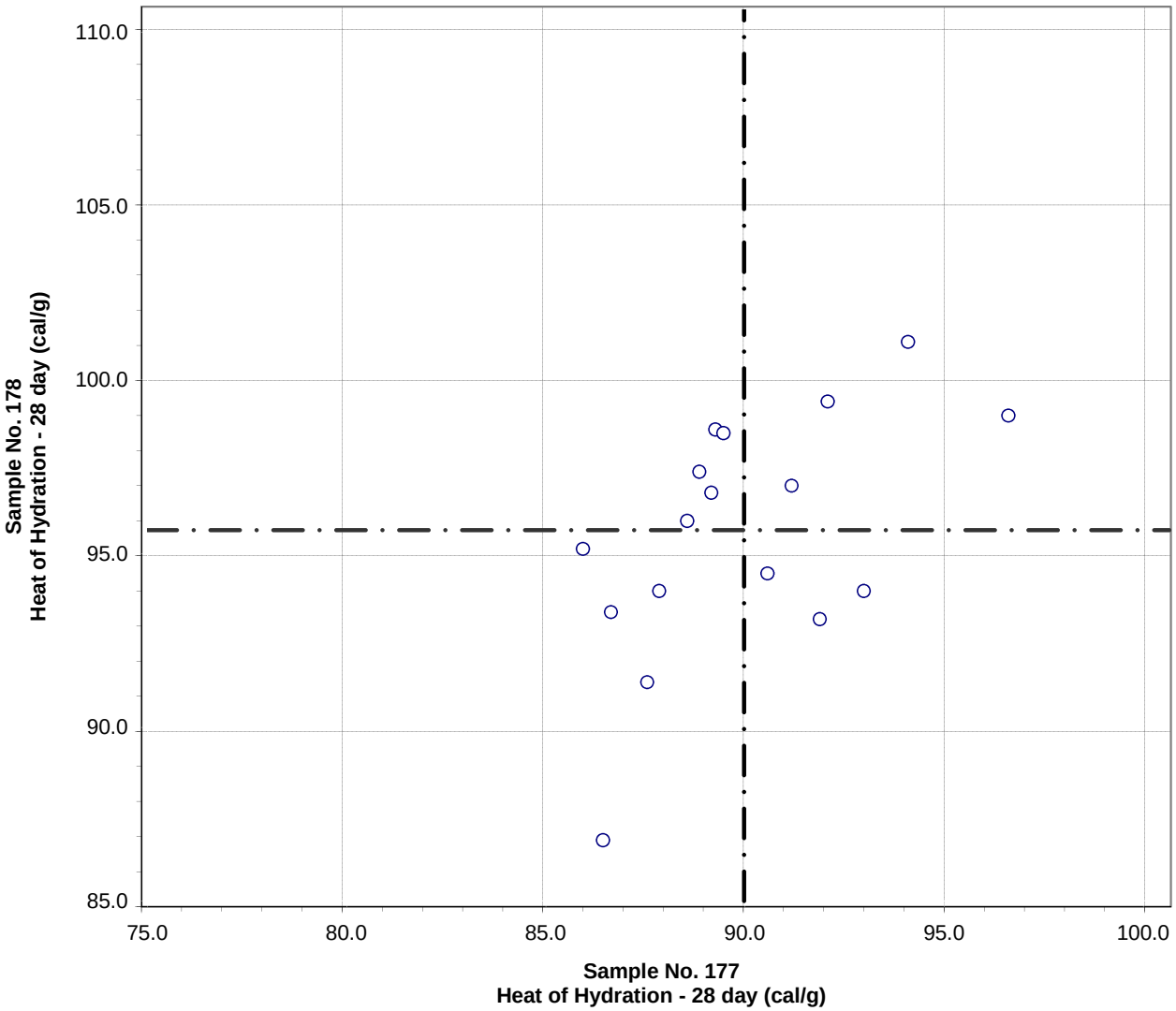
CCRL Proficiency Sample Program
C186 Heat of Hydration - 7 day
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 290 C186 Heat of Hydration - 7 day 21 Points

Sample No. 177	Ave	79.0	S.D.	3.9	C.V. 4.9
Sample No. 178	Ave	85.0	S.D.	4.3	C.V. 5.1

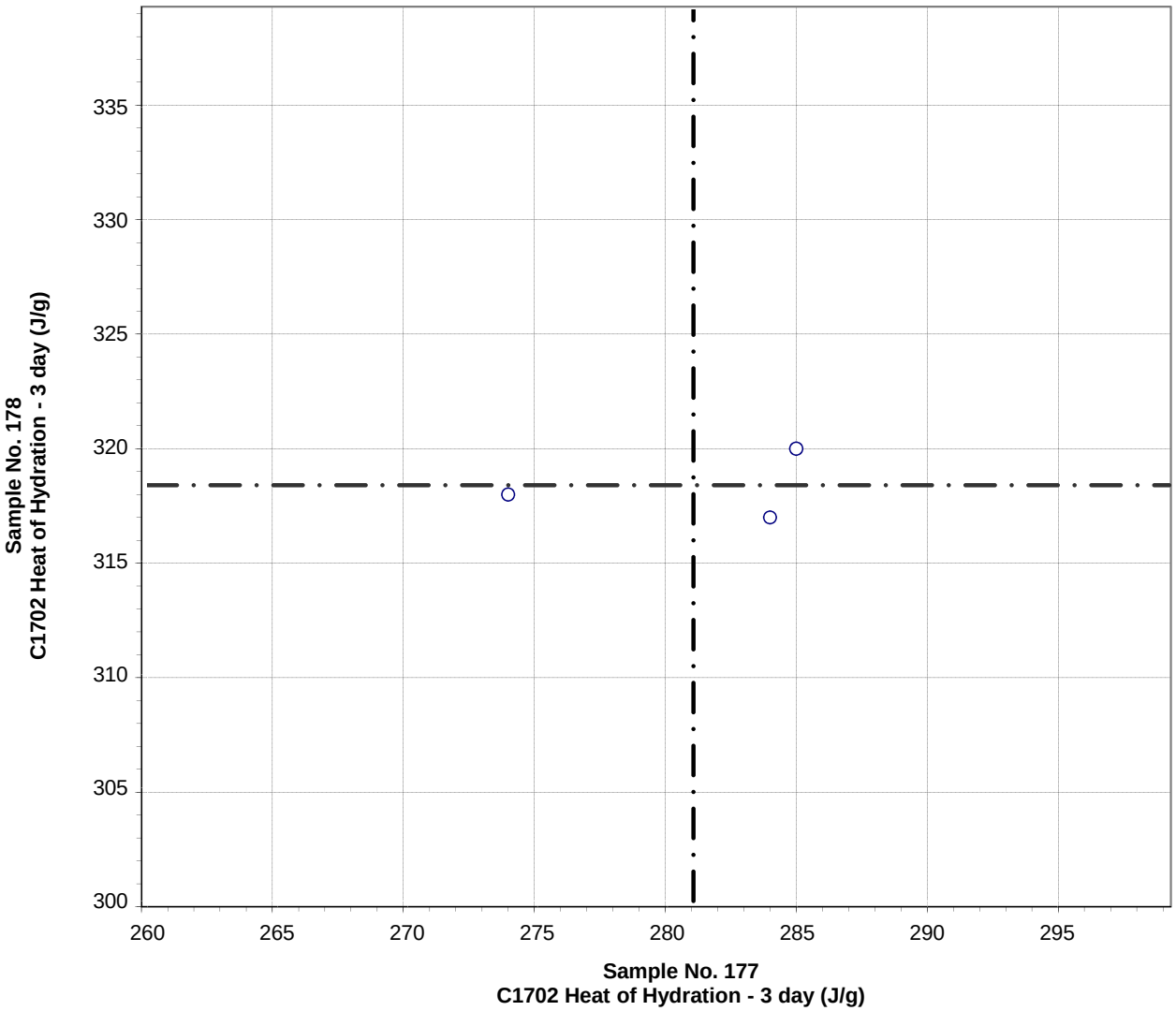
CCRL Proficiency Sample Program
C186 Heat of Hydration - 28 day
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 300 C186 Heat of Hydration - 28 day 17 Points

Sample No. 177	Ave	90.0	S.D.	2.9	C.V.	3.2
Sample No. 178	Ave	95.7	S.D.	3.5	C.V.	3.6

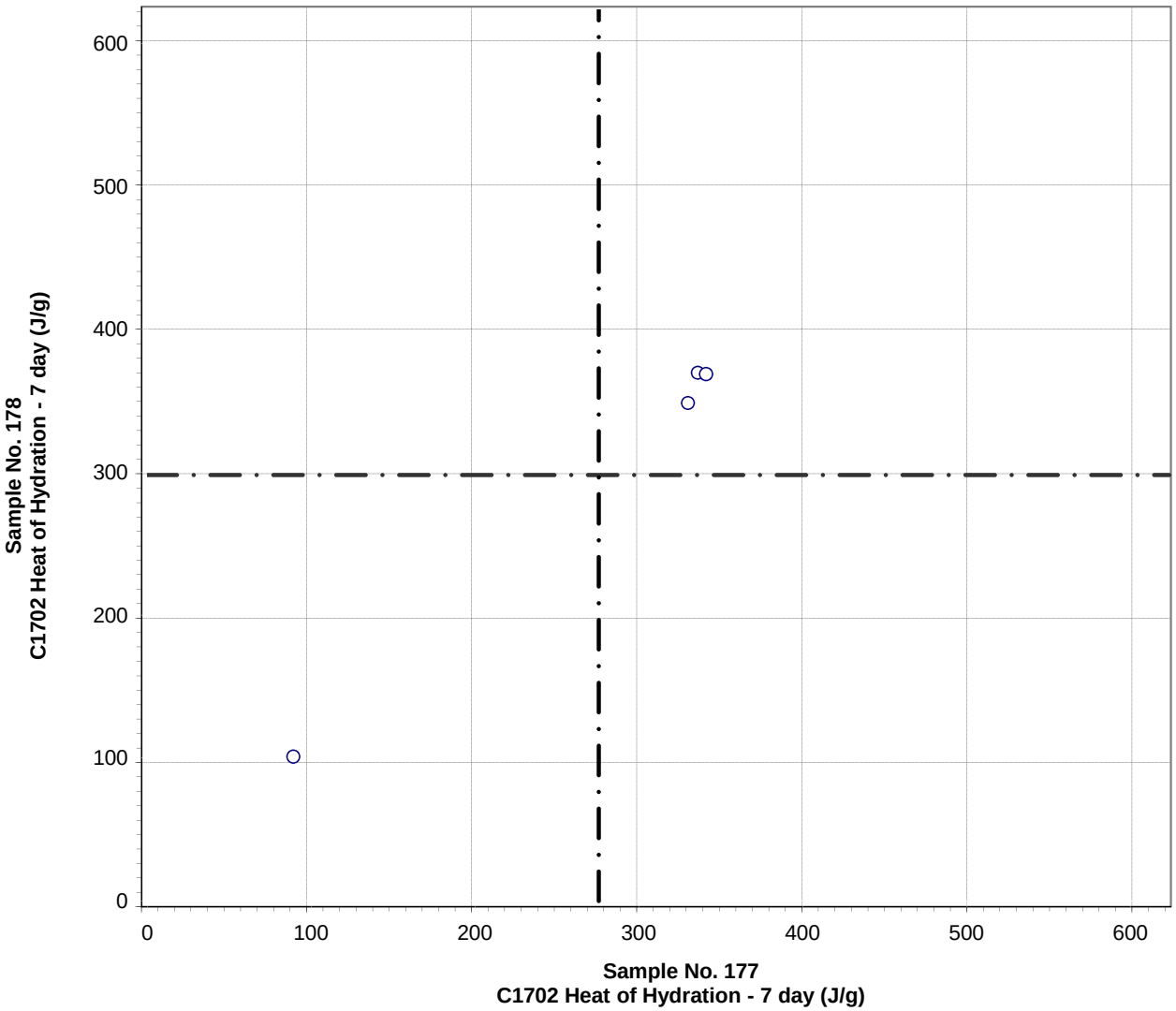
CCRL Proficiency Sample Program
C1702 Heat of Hydration - 3 day
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 500 C1702 Heat of Hydration - 3 day 3 Points

Sample No. 177	Ave	281	S.D.	6	C.V.	2.2
Sample No. 178	Ave	318	S.D.	2	C.V.	0.5

CCRL Proficiency Sample Program
C1702 Heat of Hydration - 7 day
PORTLAND CEMENT Samples No. 177 and No. 178



Test No. 510 C1702 Heat of Hydration - 7 day 4 Points

Sample No. 177	Ave	276	S.D.	122	C.V.	44
Sample No. 178	Ave	298	S.D.	130	C.V.	44