

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Portland Cement Proficiency Samples
Number 183 and Number 184

March 2012



March 23, 2012

TO: Participants in the CCRL Portland Cement Proficiency Sample Program

SUBJECT: Final Report on Portland Cement Proficiency Samples No. 183 and No. 184

Following is the final report for the current pair of CCRL **Portland Cement** Proficiency Samples which were distributed in January 2012. Portland Cement Samples No. 183 was an ASTM C150 meeting the specifications of Type I and Type II with 0.9% slag addition. Portland Cement No. 184 was an ASTM C150 meeting the specifications of Type I and Type II with 0.75% CKD addition..

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://www.ccrl.us/>. Additional information is provided in the following pages.

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 June 2012.

Sincerely,

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. 183 and No. 184

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 January 2012. 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,

¹Youden, 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. 183 and No. 184

Final Report – Primary Chemical
 March 23, 2012

SUMMARY OF RESULTS

Sample No.183

Sample No. 184

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Silicon Dioxide (percent)							
	230	20.25	0.32	1.56	20.37	0.26	1.26
	*216	20.27	0.17	0.83	20.39	0.18	0.88
* Labs Eliminated - 4, 10, 24, 25, 51, 56, 66, 93, 134, 886, 1940, 2296, 2305, 3057							
Aluminum Oxide (percent)							
	224	5.02	0.11	2.3	5.00	0.13	2.6
	*218	5.01	0.09	1.7	4.99	0.11	2.1
* Labs Eliminated - 52, 768, 1523, 2491, 3428, 3607							
Ferric Oxide (percent)							
	227	3.77	0.10	2.6	3.28	0.07	2.2
	*215	3.77	0.06	1.5	3.28	0.04	1.3
* Labs Eliminated - 10, 52, 95, 159, 222, 687, 698, 768, 886, 2435, 3297, 3661							
Calcium Oxide (percent)							
	226	63.72	0.44	0.70	63.10	0.40	0.64
	*217	63.72	0.38	0.60	63.07	0.31	0.49
* Labs Eliminated - 124, 134, 207, 667, 1940, 2466, 3057, 3607, 3661							
Magnesium Oxide (percent)							
	227	1.47	0.16	11.1	2.62	0.18	6.9
	*213	1.46	0.06	3.9	2.62	0.07	2.6
* Labs Eliminated - 48, 56, 176, 504, 768, 975, 2435, 3233, 3287, 3368, 3428, 3607, 3661, 3663							
Sulfur Trioxide (percent)							
	233	3.02	0.19	6.2	3.02	0.19	6.3
	*226	3.03	0.09	2.9	3.03	0.07	2.4
* Labs Eliminated - 4, 51, 156, 2982, 3279, 3287, 3705							
Loss on Ignition (percent)							
	236	1.20	0.13	11.2	1.12	0.15	13.8
	*227	1.19	0.09	7.4	1.11	0.08	7.3
* Labs Eliminated - 38, 137, 493, 690, 1054, 2491, 3428, 3662, 3707							

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 183 and No. 184

Final Report – Primary Chemical
March 23, 2012

SUMMARY OF RESULTS

Sample No.183

Sample No. 184

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Sodium Oxide (percent)							
	214	0.158	0.045	28	0.153	0.079	52
	*204	0.158	0.030	19	0.149	0.029	19
* Labs Eliminated - 134, 504, 557, 2352, 2464, 2477, 2490, 3233, 3235, 3663							
Potassium Oxide (percent)							
	219	0.52	0.04	8.2	0.66	0.06	9.1
	*201	0.52	0.02	2.9	0.67	0.01	2.1
* Labs Eliminated - 52, 66, 209, 289, 1251, 1523, 1940, 1956, 2465, 2466, 2477, 2491, 2621, 3233, 3279, 3662, 3663, 3705							
Titanium Dioxide (percent)							
	180	0.31	0.018	5.8	0.29	0.013	4.3
	*174	0.31	0.012	3.9	0.29	0.011	3.7
* Labs Eliminated - 93, 494, 2292, 2483, 3661, 3705							
Phosphorus Pentoxide (percent)							
	179	0.239	0.019	7.9	0.219	0.026	12.0
	*170	0.239	0.012	5.1	0.220	0.011	5.0
* Labs Eliminated - 10, 139, 176, 2463, 2483, 2491, 3233, 3235, 3428							
Zinc Oxide (percent)							
	87	0.110	0.025	23.0	0.011	0.006	55.3
	*81	0.115	0.006	4.9	0.011	0.003	30.3
* Labs Eliminated - 15, 36, 95, 415, 2296, 2491							
Manganic Oxide (percent)							
	138	0.128	0.120	93.5	0.142	0.013	9.2
	*124	0.118	0.004	3.3	0.143	0.004	2.6
* Labs Eliminated - 24, 158, 178, 203, 207, 209, 354, 457, 501, 2296, 2435, 2462, 2491, 3415							
Chloride (percent)							
	117	0.016	0.017	108	0.026	0.026	99
	*106	0.013	0.005	39	0.022	0.008	38
* Labs Eliminated - 126, 158, 206, 415, 416, 692, 1523, 2477, 2491, 3413, 3658							

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 183 and No. 184

Final Report – Primary Chemical
 March 23, 2012

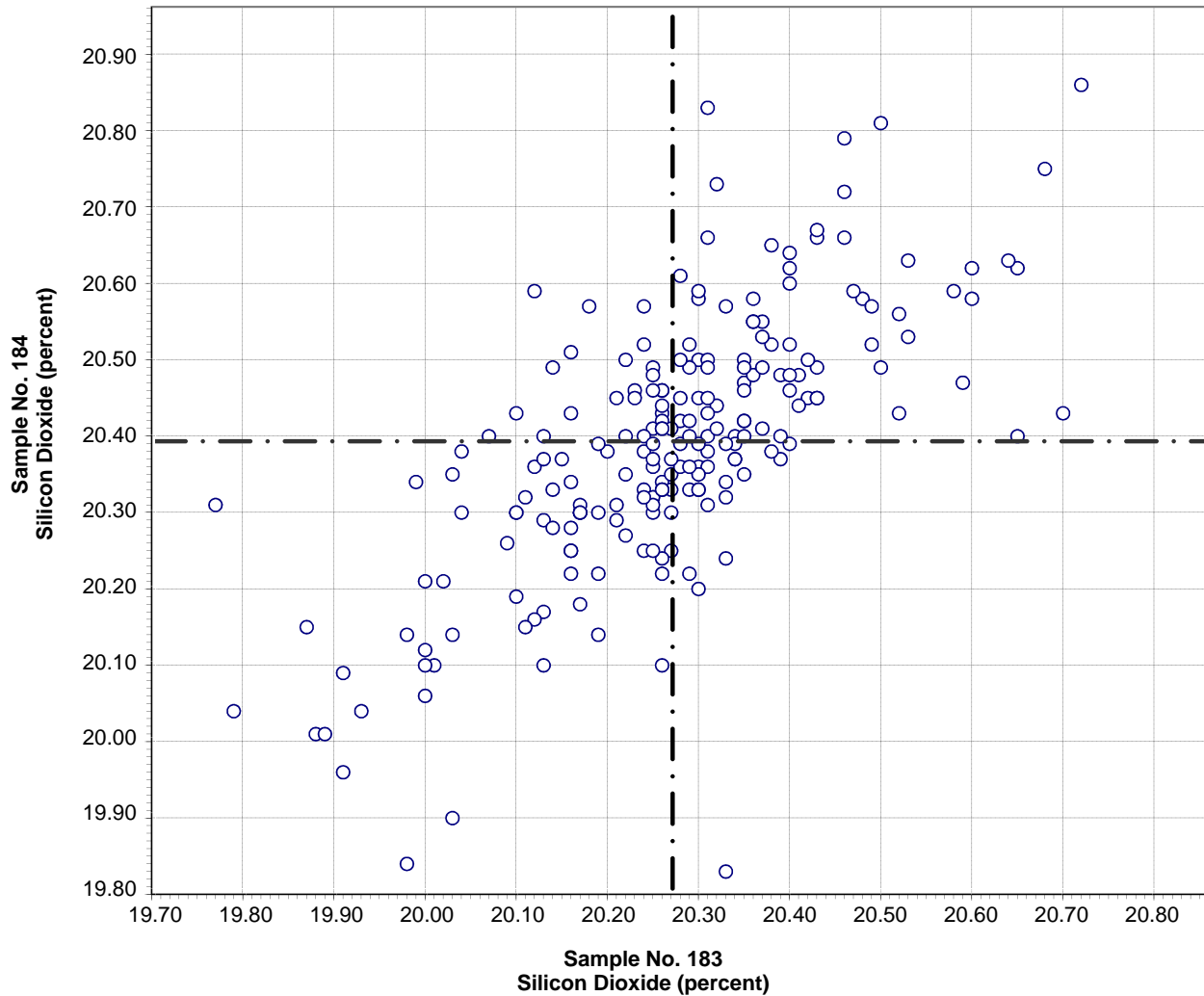
SUMMARY OF RESULTS

Sample No.183

Sample No. 184

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Insoluble Residue (percent)							
	212	0.22	0.18	81	0.34	0.15	43
	*198	0.19	0.09	47	0.32	0.08	25
* Labs Eliminated - 24, 66, 159, 206, 497, 886, 2251, 2296, 2435, 3059, 3235, 3279, 3287, 3297							
Free Lime (percent)							
	177	0.82	0.21	26	0.73	0.21	29
	*174	0.82	0.20	24	0.72	0.18	25
* Labs Eliminated - 881, 1079, 2435							
Chromium Oxide (percent)							
	89	0.022	0.007	31	0.009	0.004	46
	*83	0.021	0.004	17	0.008	0.003	32
* Labs Eliminated - 255, 408, 415, 438, 2296, 2466							
Tricalcium Silicate (percent)							
	198	58.9	2.8	4.8	54.8	2.3	4.2
	*193	59.0	2.3	3.9	54.7	2.0	3.7
* Labs Eliminated - 66, 207, 3279, 3606, 3607							
Dicalcium Silicate (percent)							
	198	12.9	2.7	20.7	16.7	2.1	12.7
	*189	12.8	2.0	15.9	16.8	1.8	10.4
* Labs Eliminated - 24, 25, 66, 93, 207, 3279, 3368, 3606, 3607							
Tricalcium Aluminate (percent)							
	198	9.8	42.6	434.7	7.6	0.3	4.1
	*190	6.8	0.2	3.7	7.6	0.3	3.5
* Labs Eliminated - 38, 105, 222, 2491, 3297, 3368, 3428, 3607							
Tetracalcium Aluminoferrite (percent)							
	198	11.5	0.4	3.6	9.9	0.2	2.3
	*188	11.5	0.2	1.5	9.9	0.1	1.3
* Labs Eliminated - 10, 93, 95, 139, 159, 222, 687, 886, 3297, 3661							

**CCRL Proficiency Sample Program
Silicon Dioxide
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 10 Silicon Dioxide 214 Points

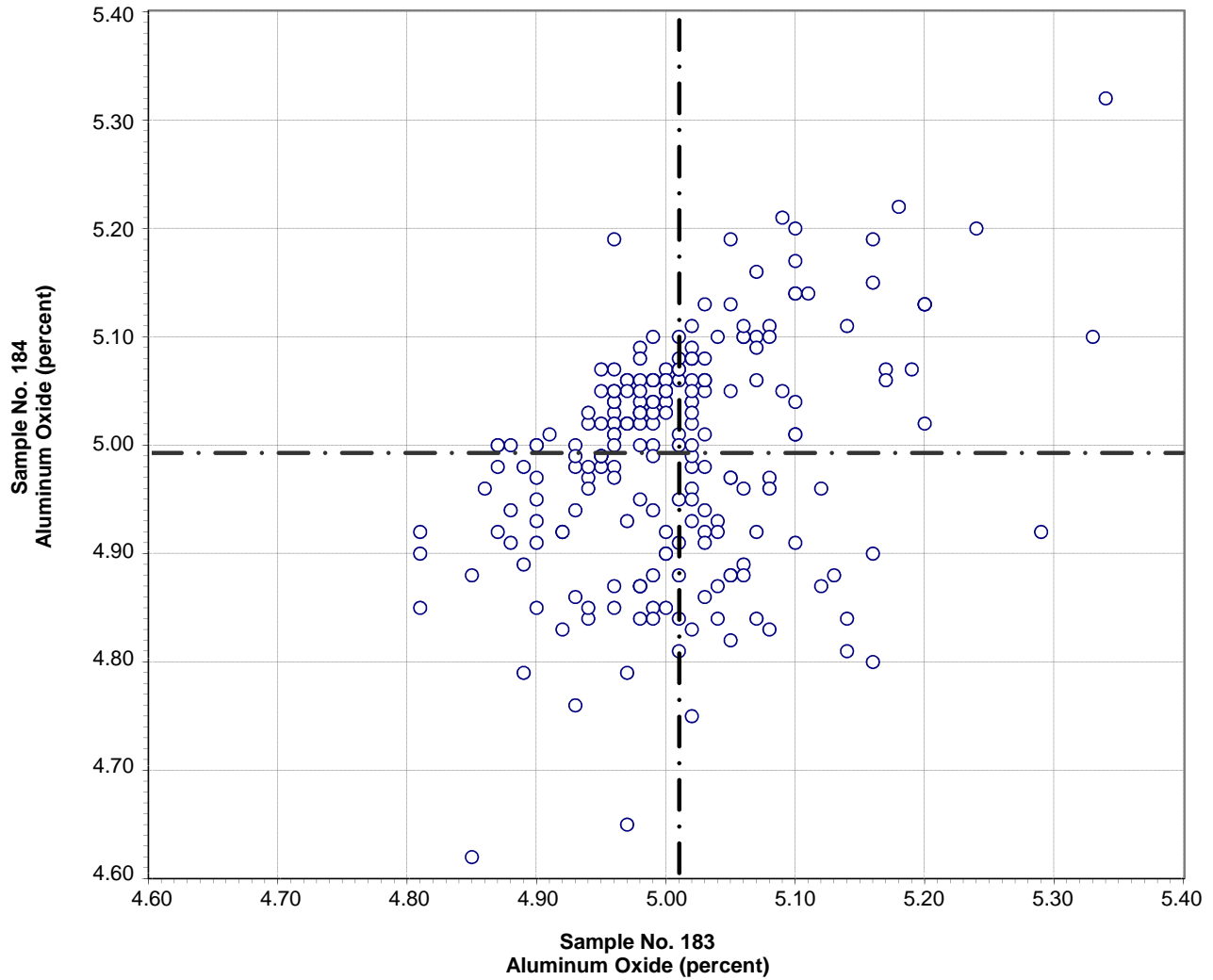
Sample No. 183 Ave 20.27 S.D. 0.17 C.V. 0.83

Sample No. 184 Ave 20.39 S.D. 0.18 C.V. 0.88

Labs Eliminated: 4, 10, 24, 25, 51, 56, 66, 93, 134, 886, 1940, 2296, 2305, 3057

Labs off Diagram: 354, 3279

**CCRL Proficiency Sample Program
Aluminum Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**



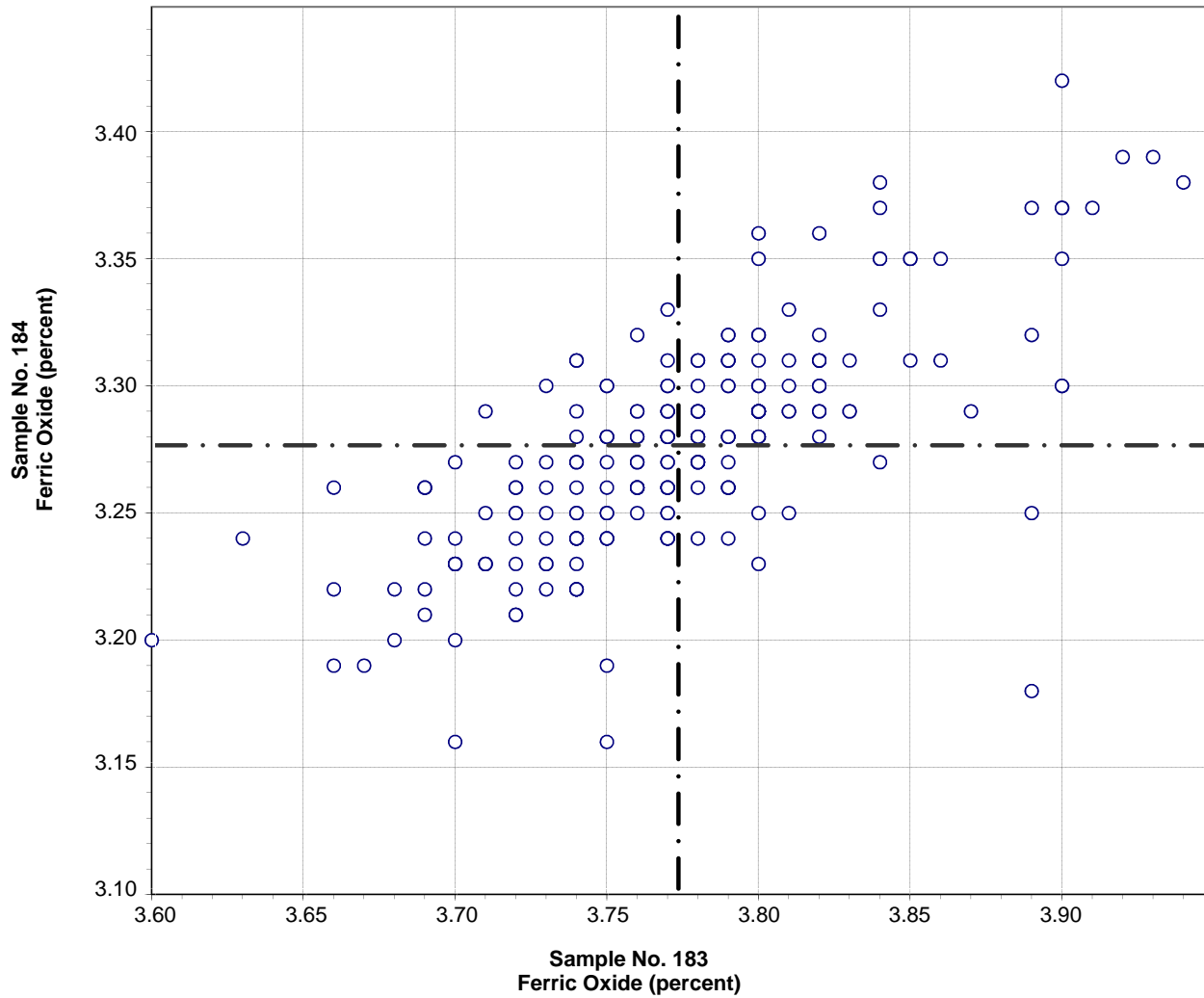
Test No. 21 Aluminum Oxide 218 Points

Sample No. 183 Ave 5.01 S.D. 0.09 C.V. 1.7

Sample No. 184 Ave 4.99 S.D. 0.11 C.V. 2.1

Labs Eliminated: 52, 768, 1523, 2491, 3428, 3607

CCRL Proficiency Sample Program
Ferric Oxide
PORTLAND CEMENT Samples No. 183 and No. 184



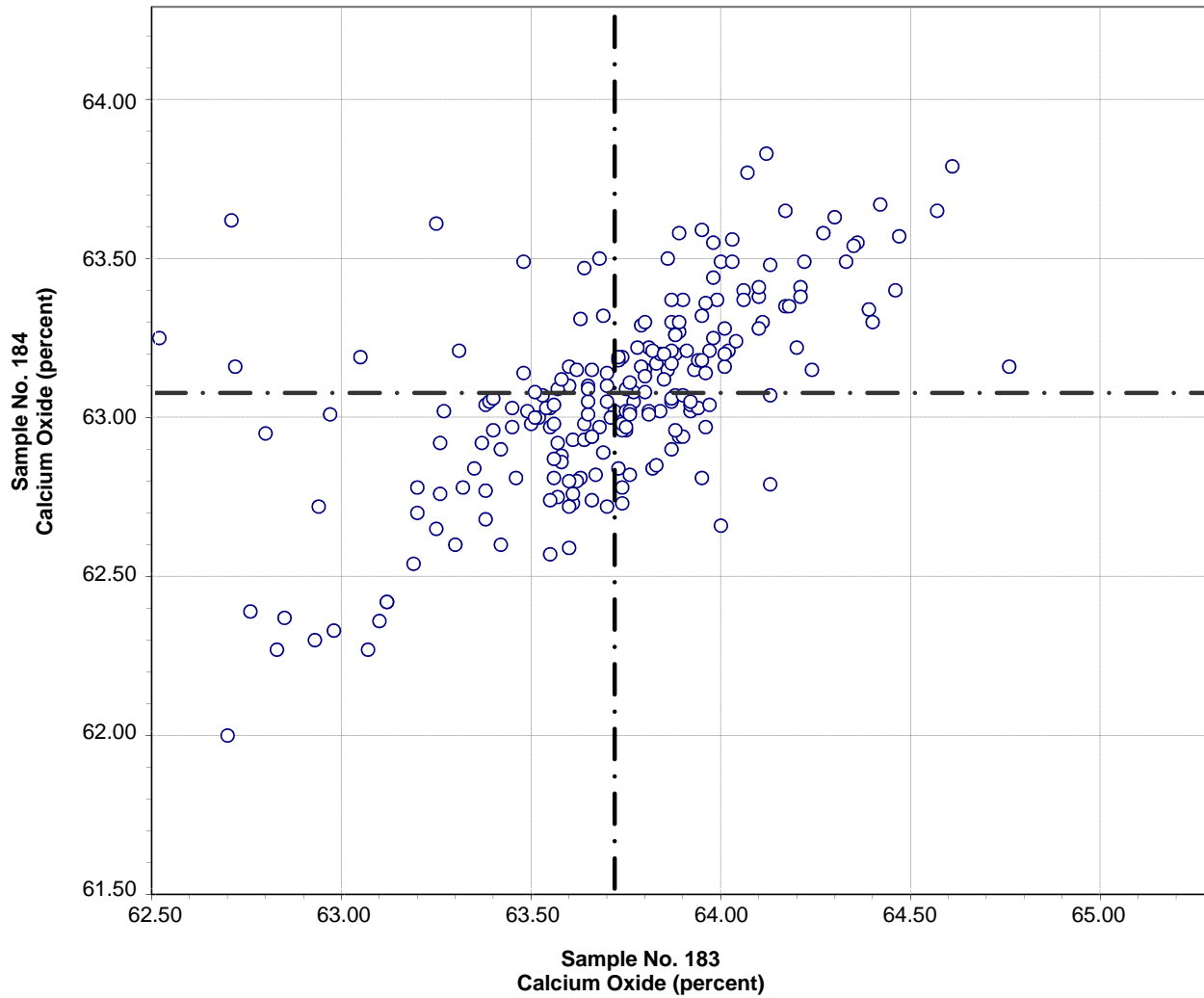
Test No. 30 Ferric Oxide 215 Points

Sample No. 183 Ave 3.77 S.D. 0.06 C.V. 1.5

Sample No. 184 Ave 3.28 S.D. 0.04 C.V. 1.3

Labs Eliminated: 10, 52, 95, 159, 222, 687, 698, 768, 886, 2435, 3297, 3661

**CCRL Proficiency Sample Program
Calcium Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 40 Calcium Oxide 216 Points

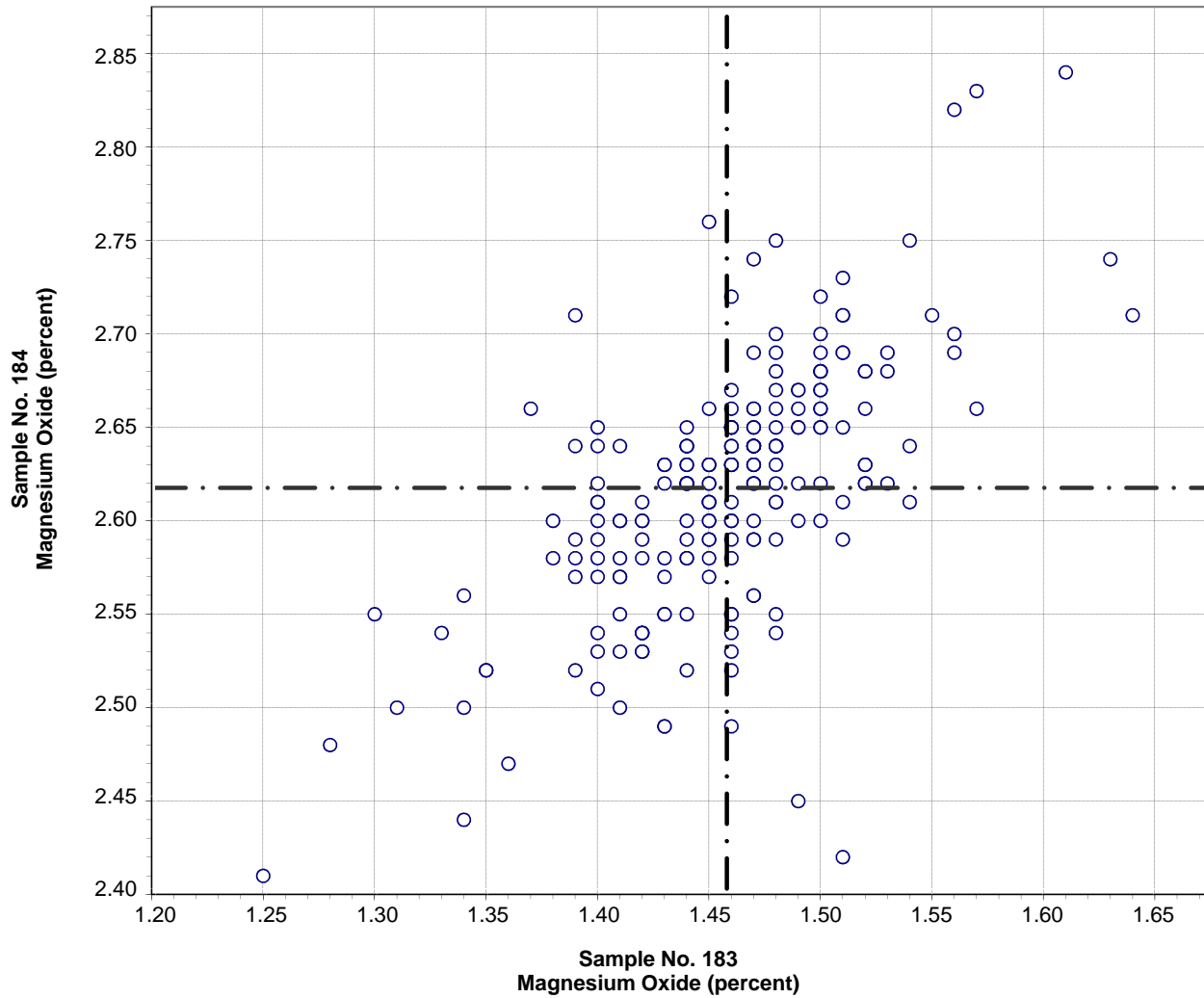
Sample No. 183 Ave 63.72 S.D. 0.38 C.V. 0.60

Sample No. 184 Ave 63.07 S.D. 0.31 C.V. 0.49

Labs Eliminated: 124, 134, 207, 667, 1940, 2466, 3057, 3607, 3661

Labs off Diagram: 66

**CCRL Proficiency Sample Program
Magnesium Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 50 Magnesium Oxide 212 Points

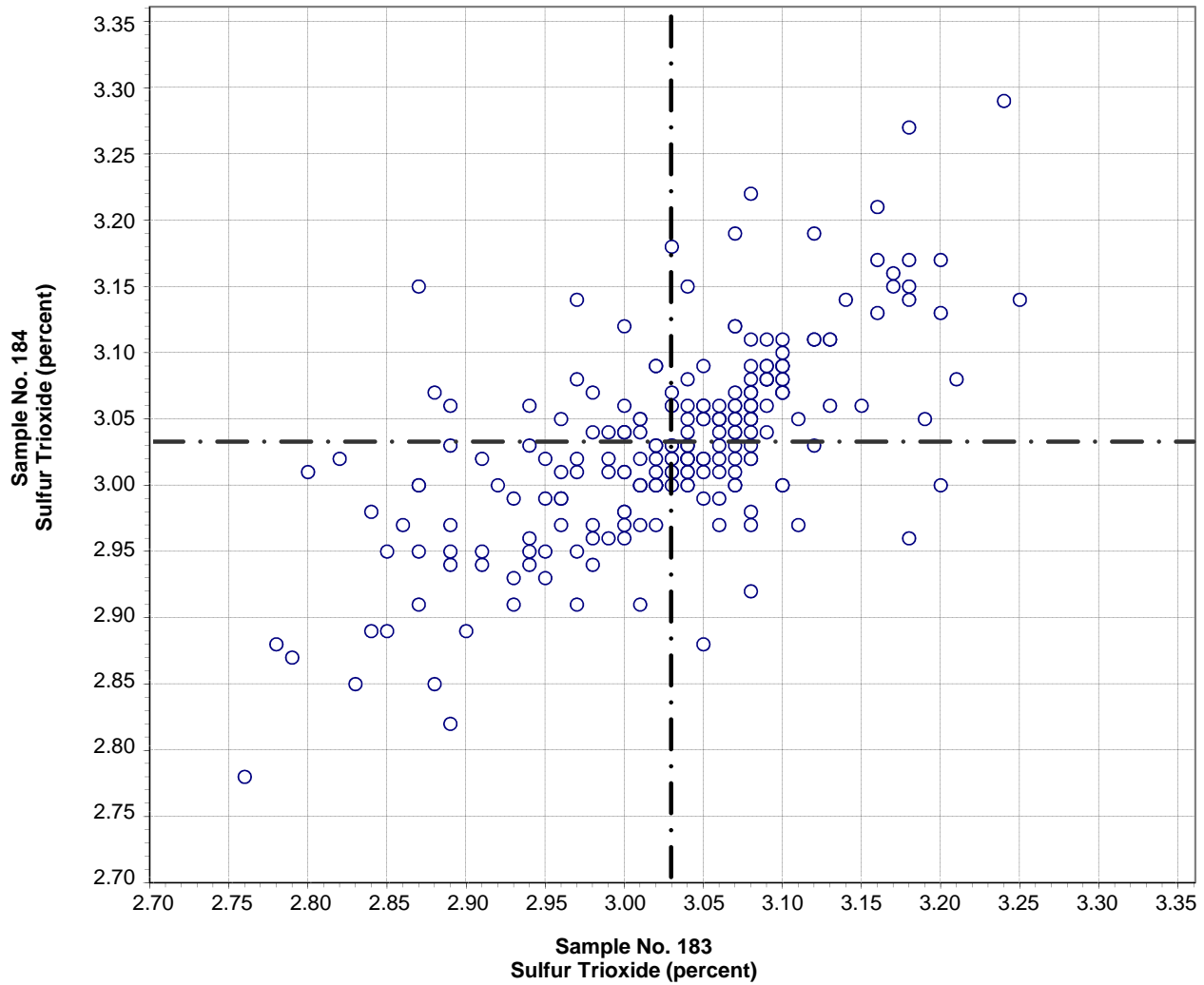
Sample No. 183 Ave 1.46 S.D. 0.06 C.V. 3.9

Sample No. 184 Ave 2.62 S.D. 0.07 C.V. 2.6

Labs Eliminated: 48, 56, 176, 504, 768, 975, 2435, 3233, 3287, 3368, 3428, 3607, 3661, 3663

Labs off Diagram: 1676

**CCRL Proficiency Sample Program
Sulfur Trioxide
PORTLAND CEMENT Samples No. 183 and No. 184**



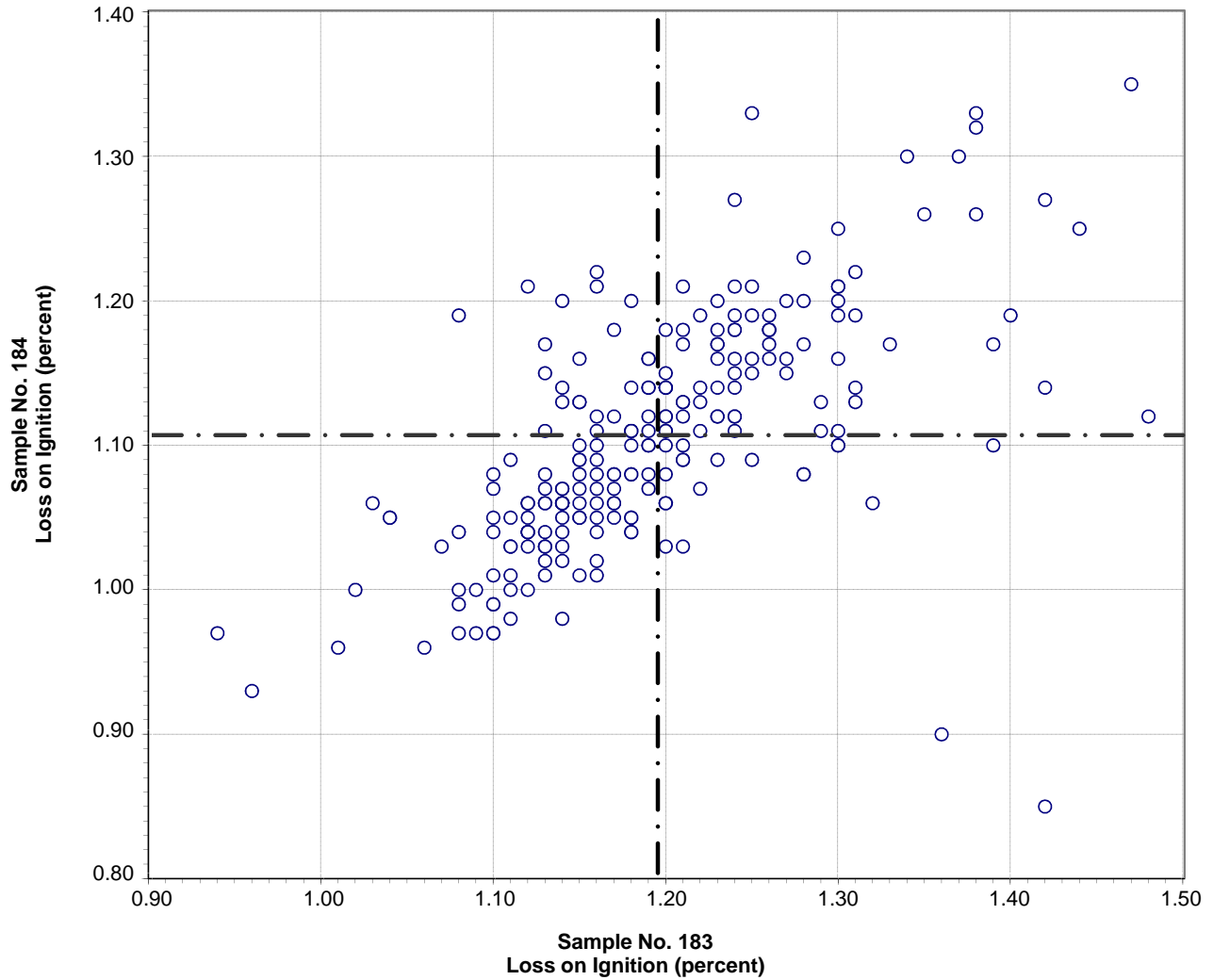
Test No. 60 Sulfur Trioxide 226 Points

Sample No. 183 Ave 3.03 S.D. 0.09 C.V. 2.9

Sample No. 184 Ave 3.03 S.D. 0.07 C.V. 2.4

Labs Eliminated: 4, 51, 156, 2982, 3279, 3287, 3705

**CCRL Proficiency Sample Program
Loss on Ignition
PORTLAND CEMENT Samples No. 183 and No. 184**



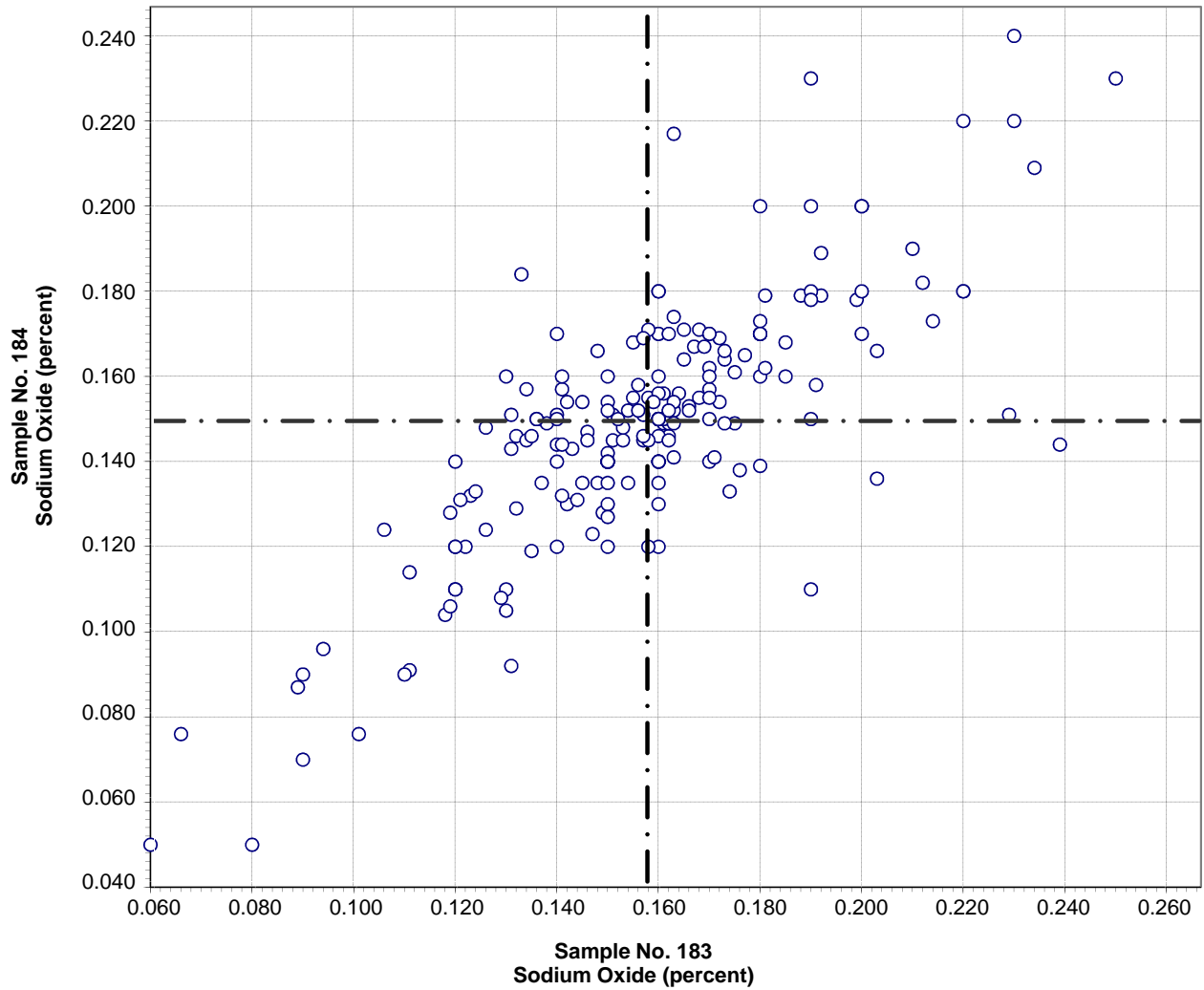
Test No. 70 Loss on Ignition 227 Points

Sample No. 183 Ave 1.19 S.D. 0.09 C.V. 7.4

Sample No. 184 Ave 1.11 S.D. 0.08 C.V. 7.3

Labs Eliminated: 38, 137, 493, 690, 1054, 2491, 3428, 3662, 3707

**CCRL Proficiency Sample Program
Sodium Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**

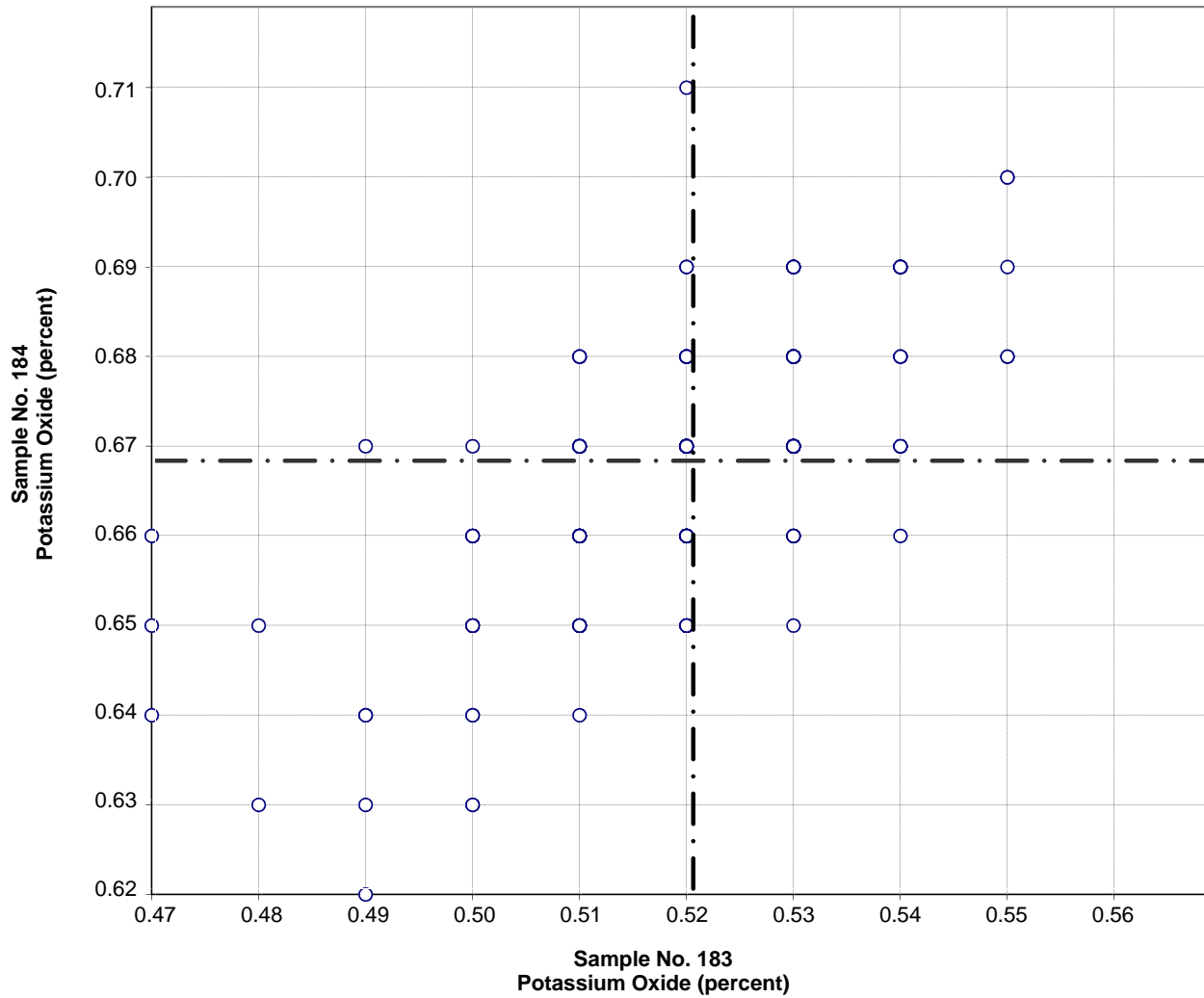


Test No. 90 Sodium Oxide 204 Points

Sample No. 183	Ave 0.158	S.D. 0.030	C.V. 19
Sample No. 184	Ave 0.149	S.D. 0.029	C.V. 19

Labs Eliminated: 134, 504, 557, 2352, 2464, 2477, 2490, 3233, 3235, 3663

**CCRL Proficiency Sample Program
Potassium Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 100 Potassium Oxide 198 Points

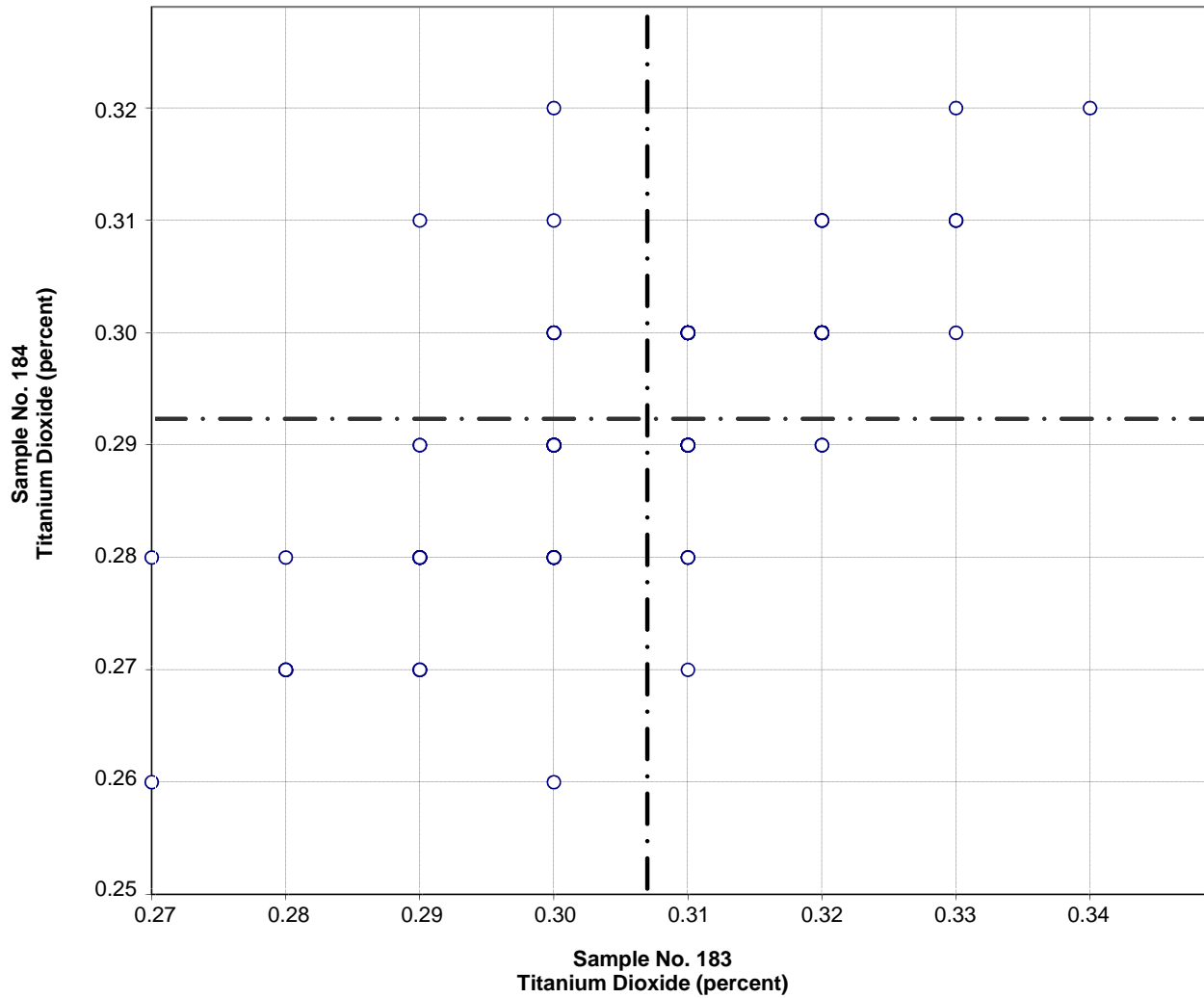
Sample No. 183 Ave 0.52 S.D. 0.02 C.V. 2.9

Sample No. 184 Ave 0.67 S.D. 0.01 C.V. 2.1

Labs Eliminated: 52, 66, 209, 289, 1251, 1523, 1940, 1956, 2465, 2466, 2477, 2491, 2621, 3233, 3279, 3662, 3663, 3705

Labs off Diagram: 284, 779, 8

**CCRL Proficiency Sample Program
Titanium Dioxide
PORTLAND CEMENT Samples No. 183 and No. 184**



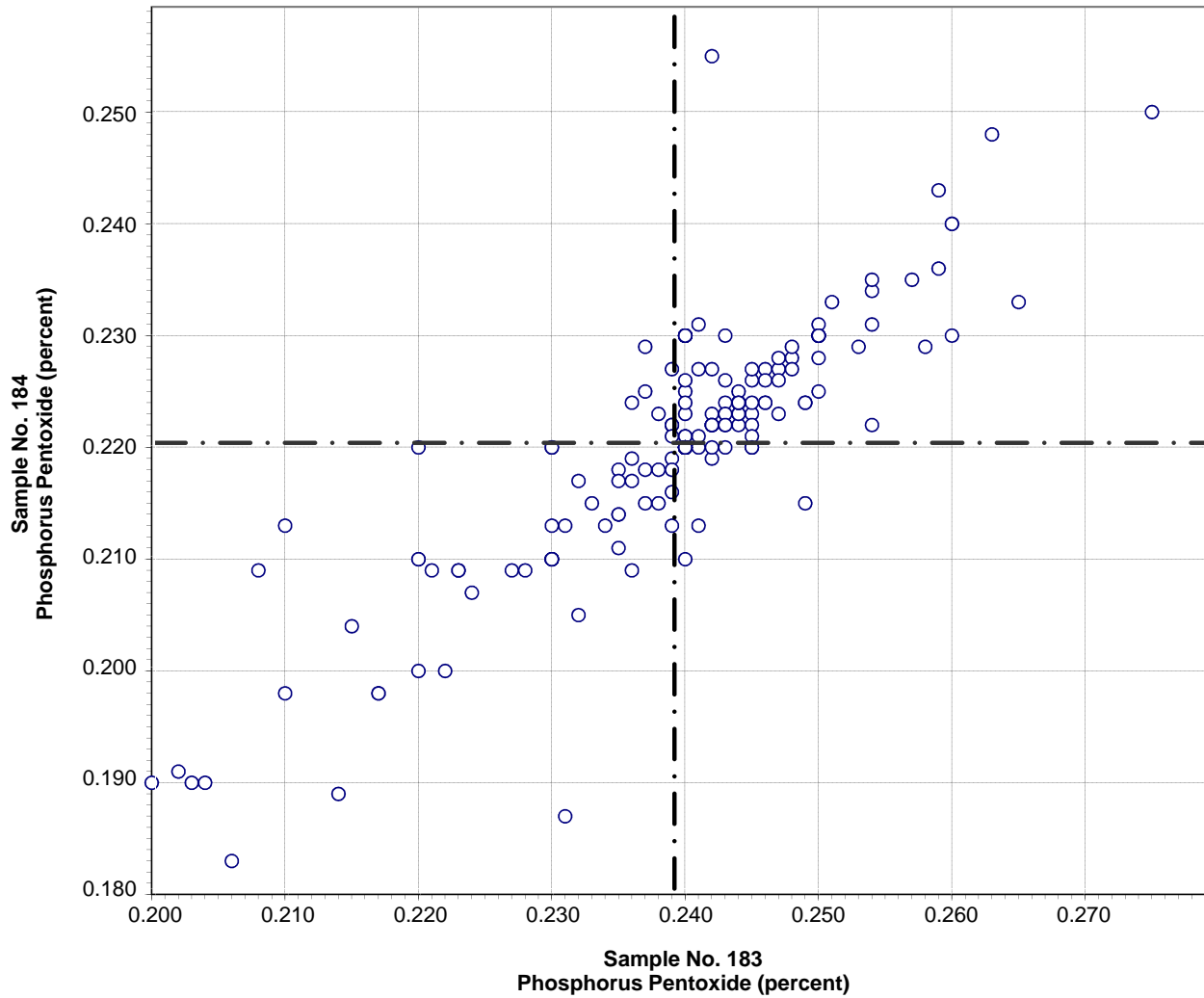
Test No. 103 Titanium Dioxide 174 Points

Sample No. 183 Ave 0.31 S.D. 0.012 C.V. 3.9

Sample No. 184 Ave 0.29 S.D. 0.011 C.V. 3.7

Labs Eliminated: 93, 494, 2292, 2483, 3661, 3705

CCRL Proficiency Sample Program
Phosphorus Pentoxide
PORTLAND CEMENT Samples No. 183 and No. 184



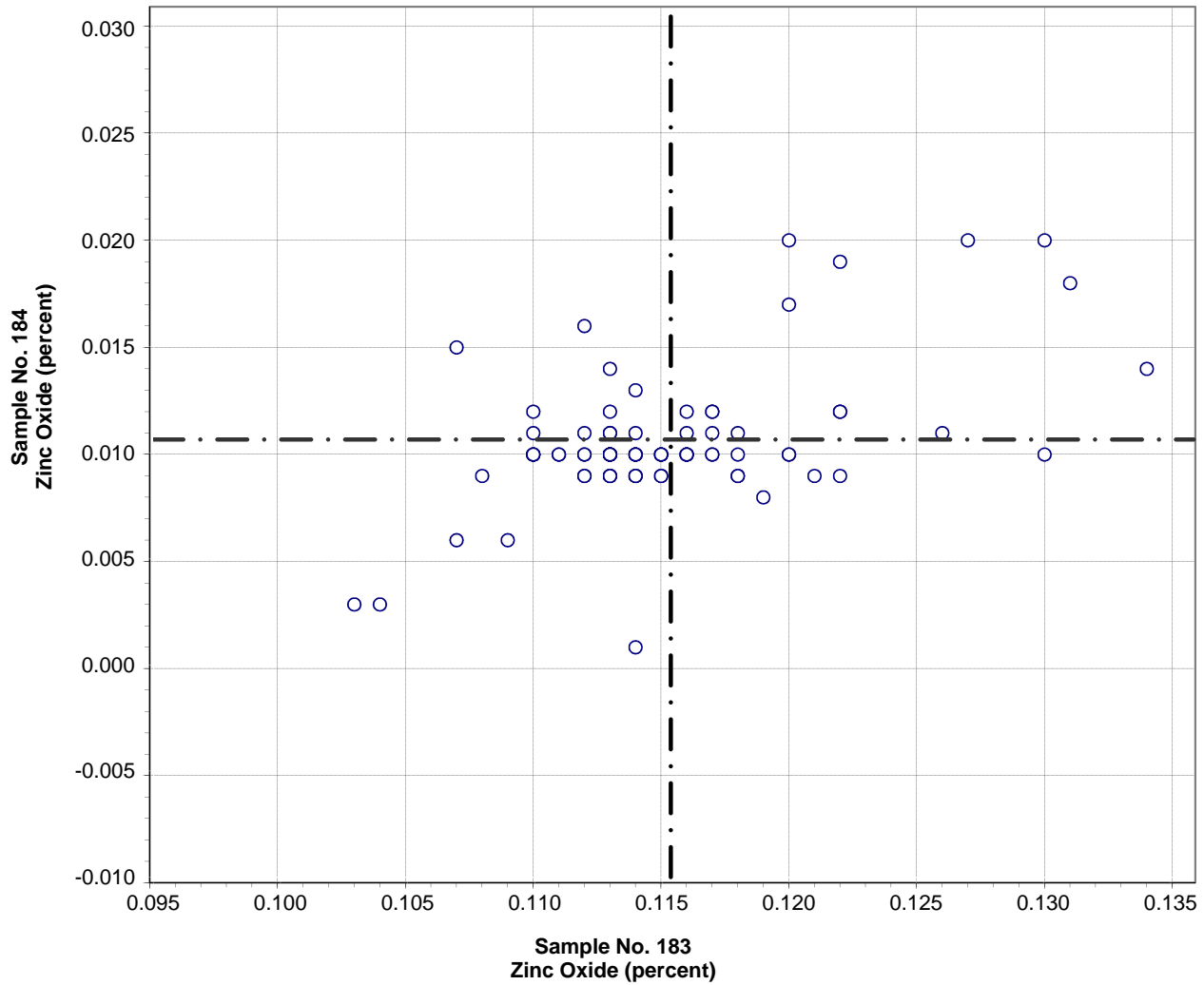
Test No. 102 Phosphorus Pentoxide 170 Points

Sample No. 183 Ave 0.239 S.D. 0.012 C.V. 5.1

Sample No. 184 Ave 0.220 S.D. 0.011 C.V. 5.0

Labs Eliminated: 10, 139, 176, 2463, 2483, 2491, 3233, 3235, 3428

**CCRL Proficiency Sample Program
Zinc Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**

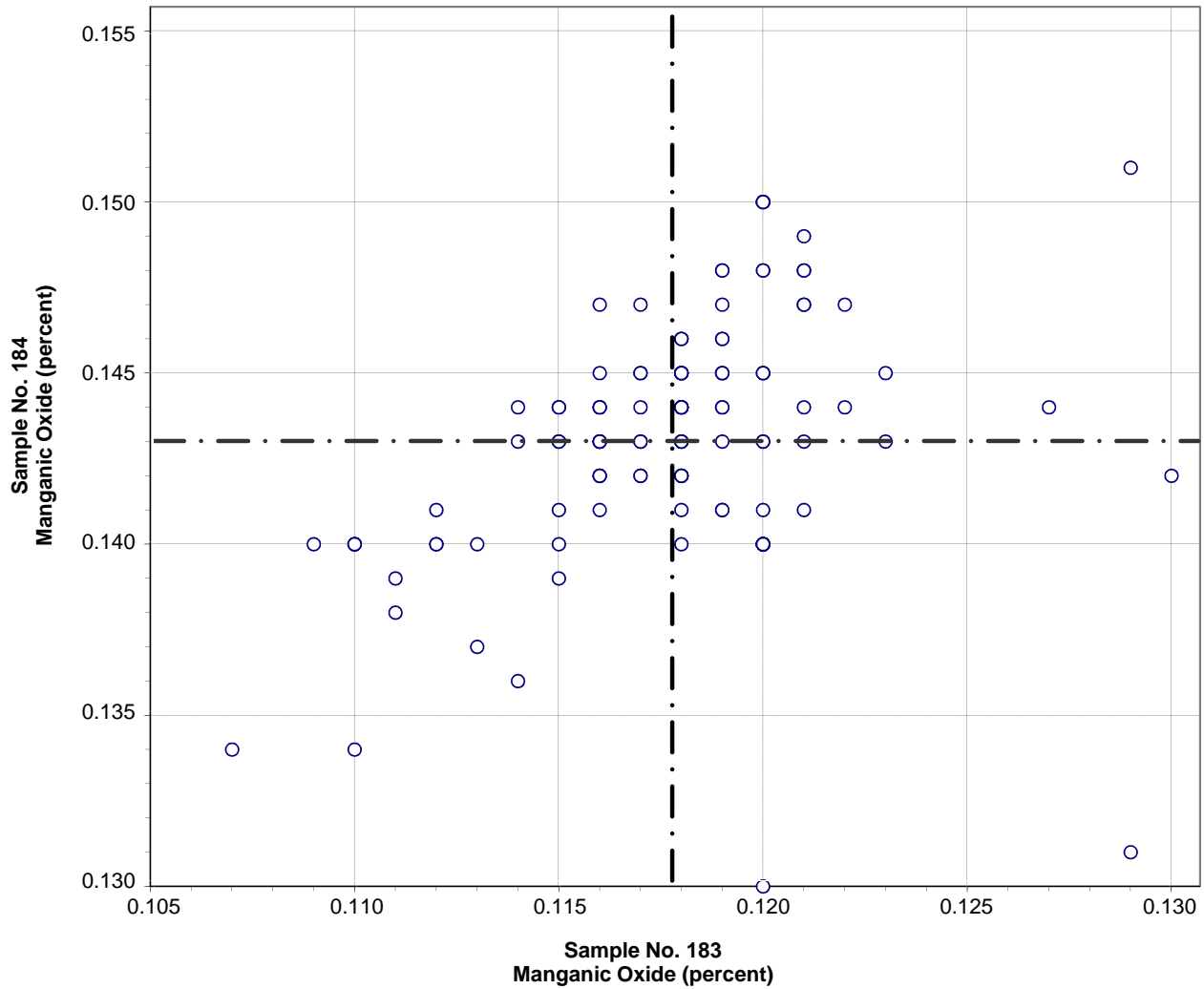


Test No. 99 Zinc Oxide 81 Points

Sample No. 183	Ave 0.115	S.D. 0.006	C.V. 4.9
Sample No. 184	Ave 0.011	S.D. 0.003	C.V. 30.3

Labs Eliminated: 15, 36, 95, 415, 2296, 2491

**CCRL Proficiency Sample Program
Manganic Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**



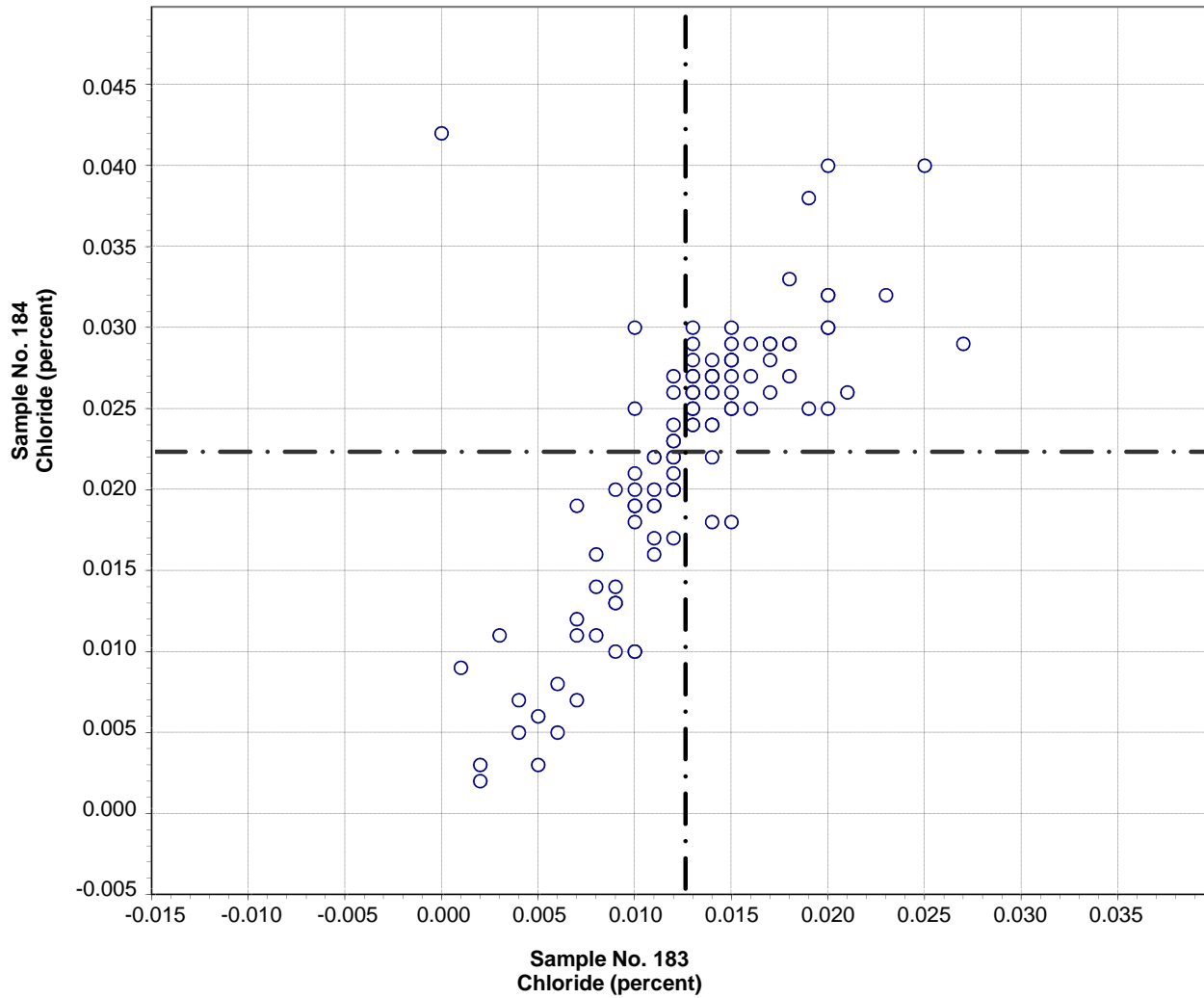
Test No. 101 Manganic Oxide 123 Points

Sample No. 183 Ave 0.118 S.D. 0.004 C.V. 3.3
 Sample No. 184 Ave 0.143 S.D. 0.004 C.V. 2.6

Labs Eliminated: 24, 158, 178, 203, 207, 209, 354, 457, 501, 2296, 2435, 2462,
 2491, 3415

Labs off Diagram: 27

**CCRL Proficiency Sample Program
Chloride
PORTLAND CEMENT Samples No. 183 and No. 184**

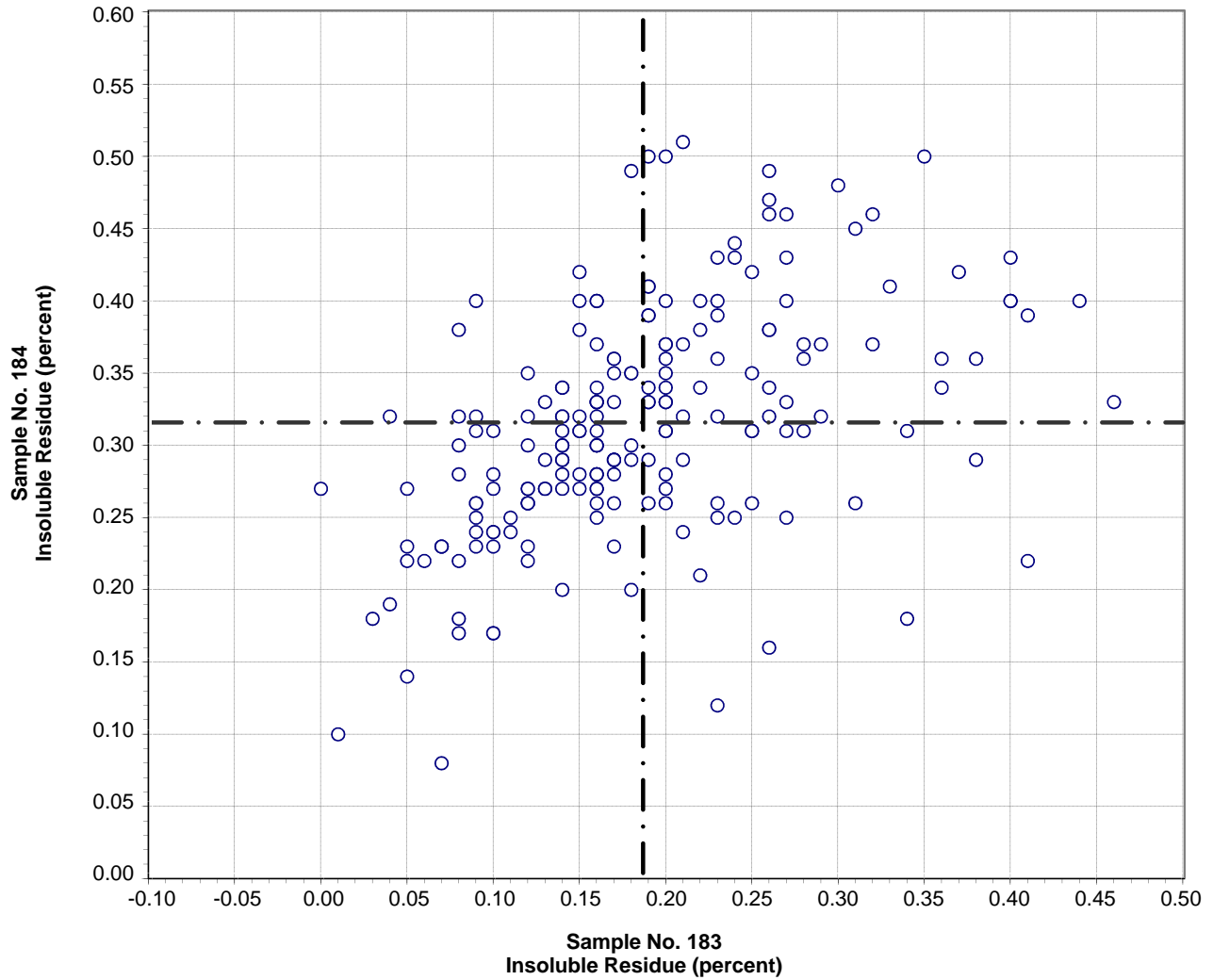


Test No. 104 Chloride 106 Points

Sample No. 183	Ave 0.013	S.D. 0.005	C.V. 39
Sample No. 184	Ave 0.022	S.D. 0.008	C.V. 38

Labs Eliminated: 126, 158, 206, 415, 416, 692, 1523, 2477, 2491, 3413, 3658

**CCRL Proficiency Sample Program
Insoluble Residue
PORTLAND CEMENT Samples No. 183 and No. 184**



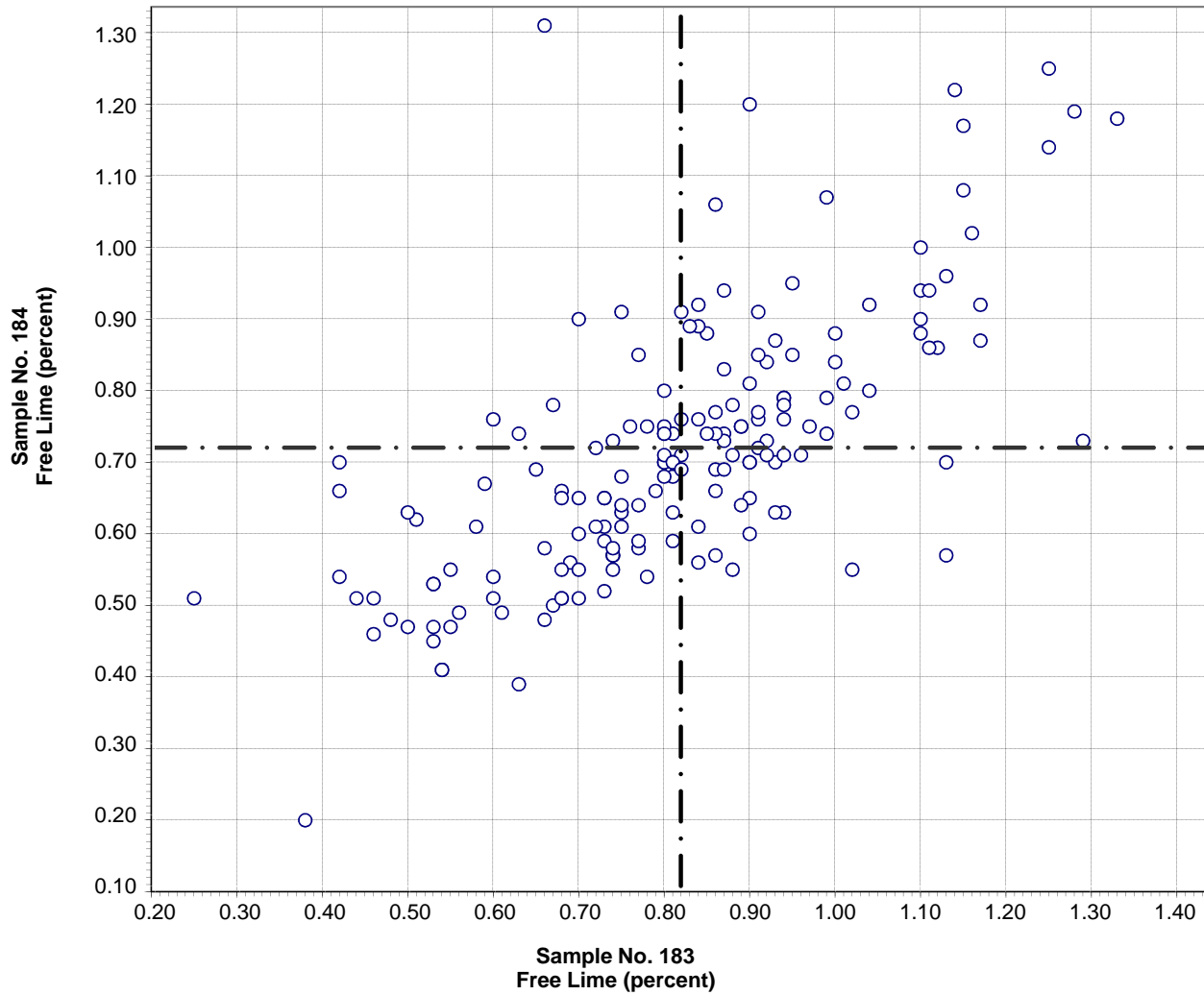
Test No. 80 Insoluble Residue 198 Points

Sample No. 183 Ave 0.19 S.D. 0.09 C.V. 47

Sample No. 184 Ave 0.32 S.D. 0.08 C.V. 25

Labs Eliminated: 24, 66, 159, 206, 497, 886, 2251, 2296, 2435, 3059, 3235, 3279,
3287, 3297

CCRL Proficiency Sample Program
Free Lime
PORTLAND CEMENT Samples No. 183 and No. 184



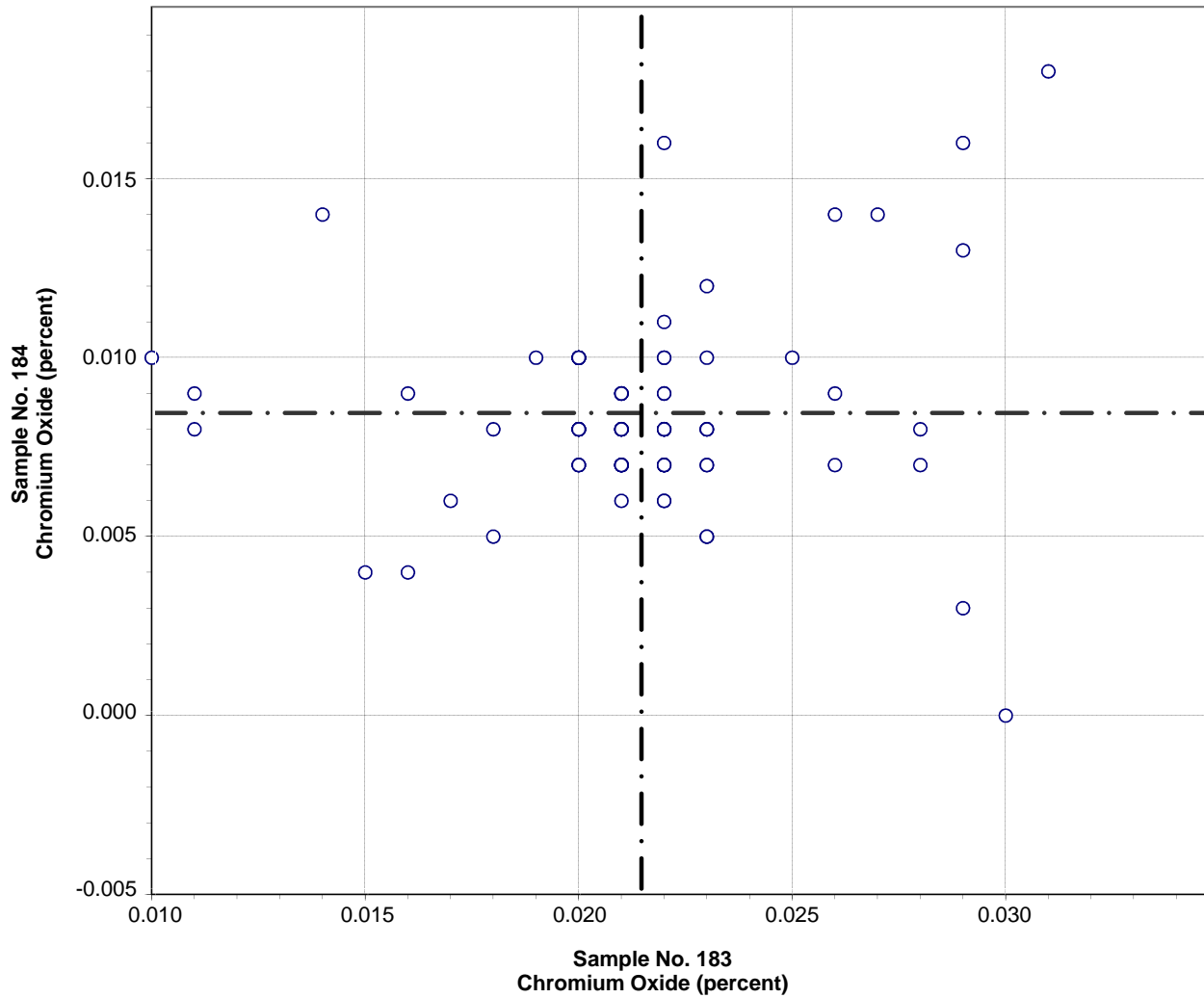
Test No. 41 Free Lime 174 Points

Sample No. 183 Ave 0.82 S.D. 0.20 C.V. 24

Sample No. 184 Ave 0.72 S.D. 0.18 C.V. 25

Labs Eliminated: 881, 1079, 2435

**CCRL Proficiency Sample Program
Chromium Oxide
PORTLAND CEMENT Samples No. 183 and No. 184**



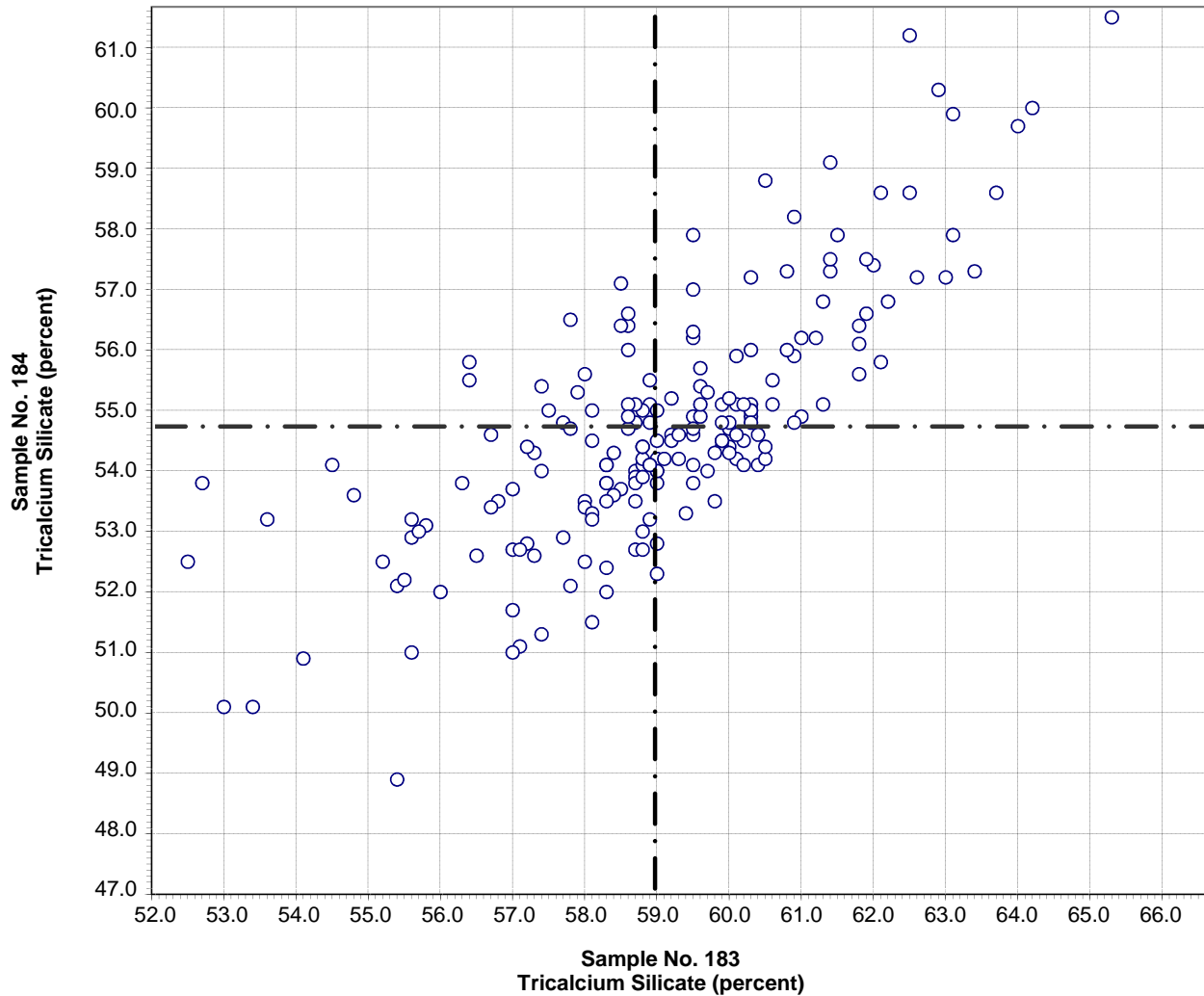
Test No. 105 Chromium Oxide 83 Points

Sample No. 183 Ave 0.021 S.D. 0.004 C.V. 17

Sample No. 184 Ave 0.008 S.D. 0.003 C.V. 32

Labs Eliminated: 255, 408, 415, 438, 2296, 2466

**CCRL Proficiency Sample Program
Tricalcium Silicate
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 106 Tricalcium Silicate 191 Points

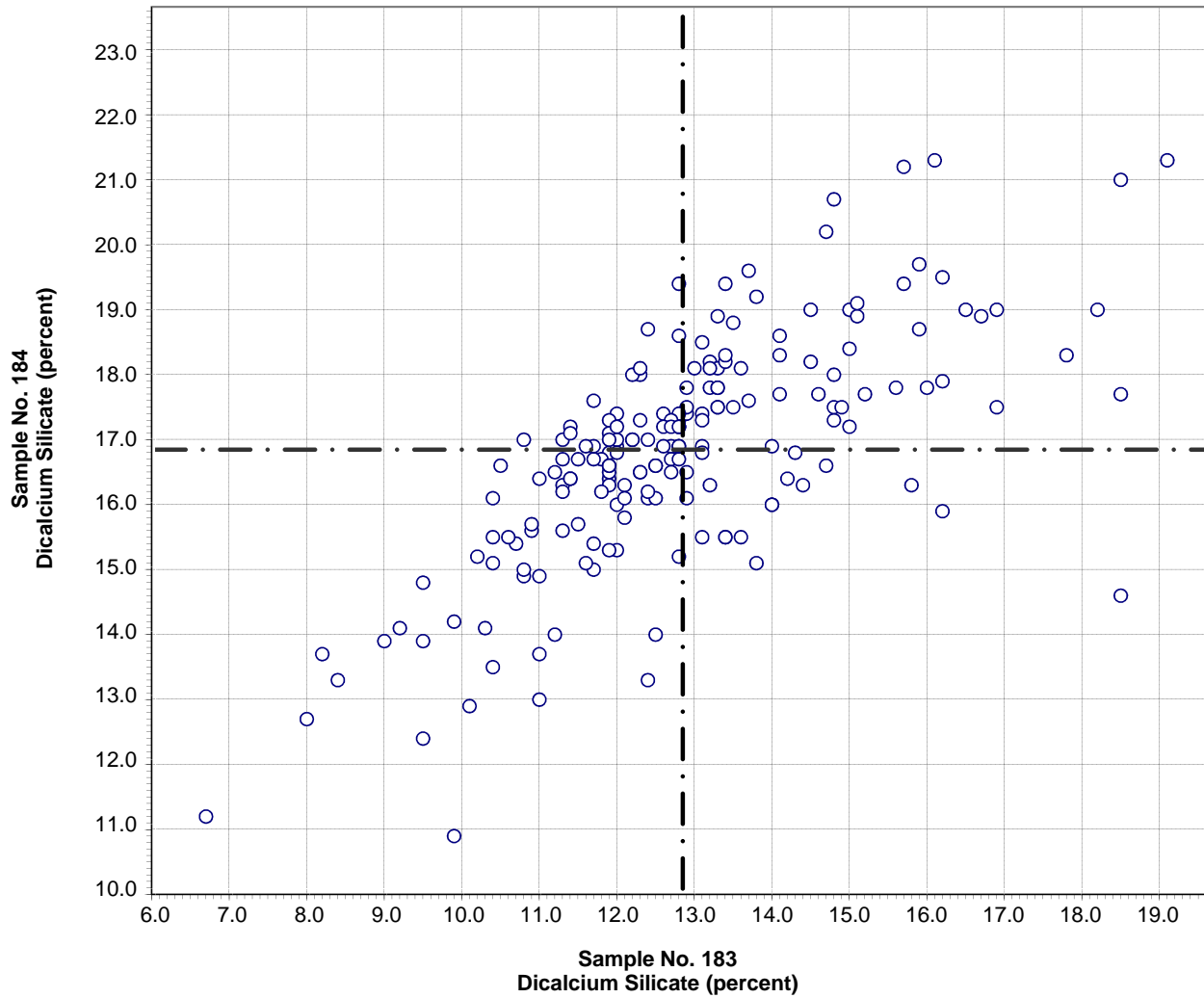
Sample No. 183 Ave 59.0 S.D. 2.3 C.V. 3.9

Sample No. 184 Ave 54.7 S.D. 2.0 C.V. 3.7

Labs Eliminated: 66, 207, 3279, 3606, 3607

Labs off Diagram: 93, 2477

**CCRL Proficiency Sample Program
Dicalcium Silicate
PORTLAND CEMENT Samples No. 183 and No. 184**



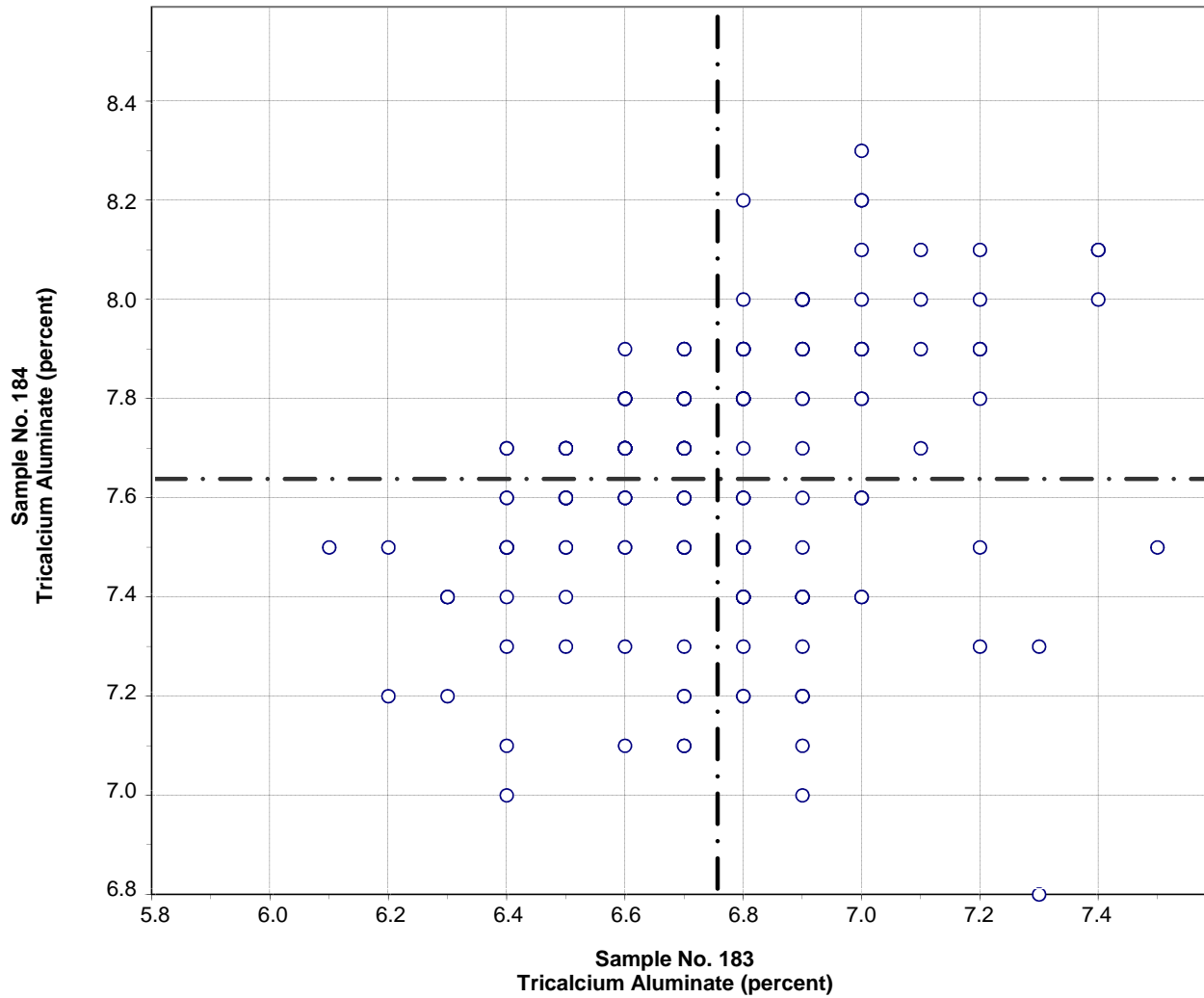
Test No. 107 Dicalcium Silicate 189 Points

Sample No. 183 Ave 12.8 S.D. 2.0 C.V. 15.9

Sample No. 184 Ave 16.8 S.D. 1.8 C.V. 10.4

Labs Eliminated: 24, 25, 66, 93, 207, 3279, 3368, 3606, 3607

**CCRL Proficiency Sample Program
Tricalcium Aluminate
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 108 Tricalcium Aluminate 189 Points

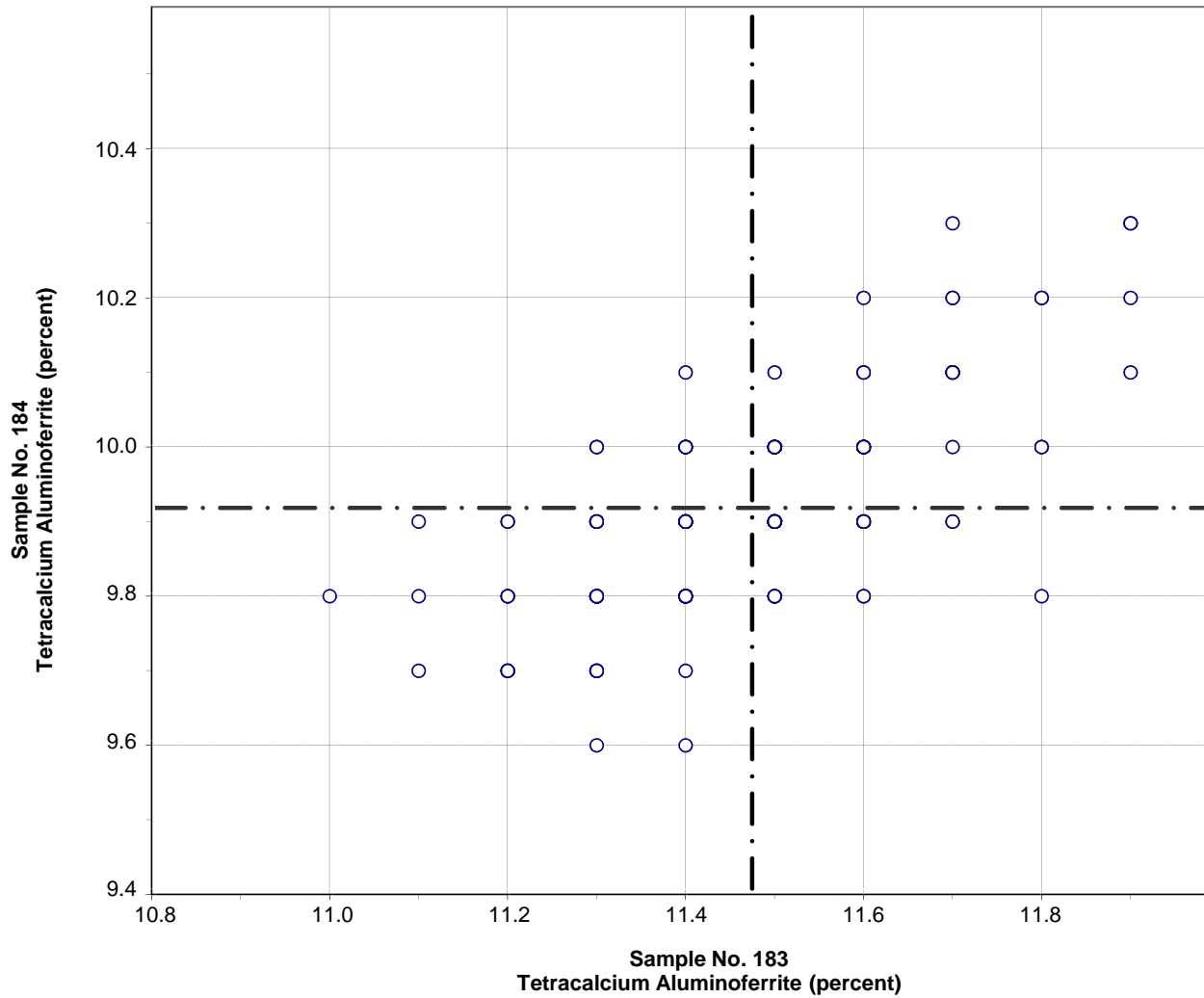
Sample No. 183 Ave 6.8 S.D. 0.2 C.V. 3.7

Sample No. 184 Ave 7.6 S.D. 0.3 C.V. 3.5

Labs Eliminated: 38, 105, 222, 2491, 3297, 3368, 3428, 3607

Labs off Diagram: 10

**CCRL Proficiency Sample Program
Tetracalcium Aluminoferrite
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 109 Tetracalcium Aluminoferrite 186 Points

Sample No. 183 Ave 11.5 S.D. 0.2 C.V. 1.5

Sample No. 184 Ave 9.9 S.D. 0.1 C.V. 1.3

Labs Eliminated: 10, 93, 95, 139, 159, 222, 687, 886, 3297, 3661

Labs off Diagram: 156, 3428

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 183 and No. 184

Final Report – Physical Results
 March 23, 2012

SUMMARY OF RESULTS

Sample No.183

Sample No. 184

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Normal Consistency - % Water (percent)							
	246	26.2	1.49	5.70	25.4	1.54	6.10
	*240	26.1	0.41	1.60	25.3	0.38	1.50
* Labs Eliminated - 52, 246, 736, 1483, 3057, 3235							
Vicat Time of Set - Initial (minutes)							
	242	139	17	12	131	16	12
	*237	138	15	11	130	13	10
* Labs Eliminated - 5, 1435, 1483, 3144, 3235							
Vicat Time of Set - Final (minutes)							
	232	249	28	11	235	28	12
	*228	249	26	10	235	26	11
* Labs Eliminated - 2, 14, 1251, 2296							
Gillmore Time of Set - Initial (minutes)							
	145	179	26	15	163	24	15
	*143	178	25	14	162	23	14
* Labs Eliminated - 15, 176							
Gillmore Time of Set - Final (minutes)							
	145	283	35	13	269	37	14
	*141	280	30	11	265	31	12
* Labs Eliminated - 15, 408, 515, 694							
False Set - Paste Method (percent)							
	190	77	9.4	12	67	12.1	18
	*187	78	8.5	11	67	11.1	16
* Labs Eliminated - 69, 162, 181							
Autoclave Expansion (percent)							
	223	-0.02	0.062	-228	0.01	0.031	339
	*205	-0.02	0.019	-71	0.01	0.012	144
* Labs Eliminated - 22, 26, 34, 36, 84, 98, 221, 284, 360, 413, 440, 667, 691, 1054, 1940, 2254, 3662, 3695							

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 183 and No. 184

Final Report – Physical Results
 March 23, 2012

SUMMARY OF RESULTS

Sample No.183

Sample No. 184

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Air Content % (percent)							
	216	7.9	1.2	16	7.8	1.2	15
	*212	7.9	1.1	14	7.8	1.0	13
* Labs Eliminated - 6, 18, 360, 2490							
Air Content - % Water (percent)							
	215	73.0	28.2	38.6	73.1	28.3	38.7
	*207	69.4	2.6	3.7	69.7	2.8	4.0
* Labs Eliminated - 23, 43, 123, 157, 178, 354, 823, 1054							
Air Content - Flow (percent)							
	215	87	3.7	4.3	86	3.9	4.6
	*214	87	3.2	3.6	86	3.2	3.8
* Labs Eliminated - 142							
Compressive Strength - 3 day (psi)							
	250	3955	274	6.9	3710	288	7.8
	*245	3956	253	6.4	3714	265	7.1
* Labs Eliminated - 2, 74, 360, 2360, 3135							
Compressive Strength - 7 day (psi)							
	250	5037	332	6.6	4573	316	6.9
	*243	5040	291	5.8	4578	275	6.0
* Labs Eliminated - 74, 103, 360, 2360, 3135, 3144, 3297							
Compressive Strength - 28 day (psi)							
	229	6791	486	7.2	6020	421	7.0
	*224	6812	434	6.4	6041	355	5.9
* Labs Eliminated - 52, 360, 3057, 3144, 3297							
Compressive Strength - Flow (percent)							
	228	113	11	10.1	112	12	10.3
	*224	114	10	8.7	113	10	8.9
* Labs Eliminated - 34, 47, 222, 3695							

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 183 and No. 184

Final Report – Physical Results
 March 23, 2012

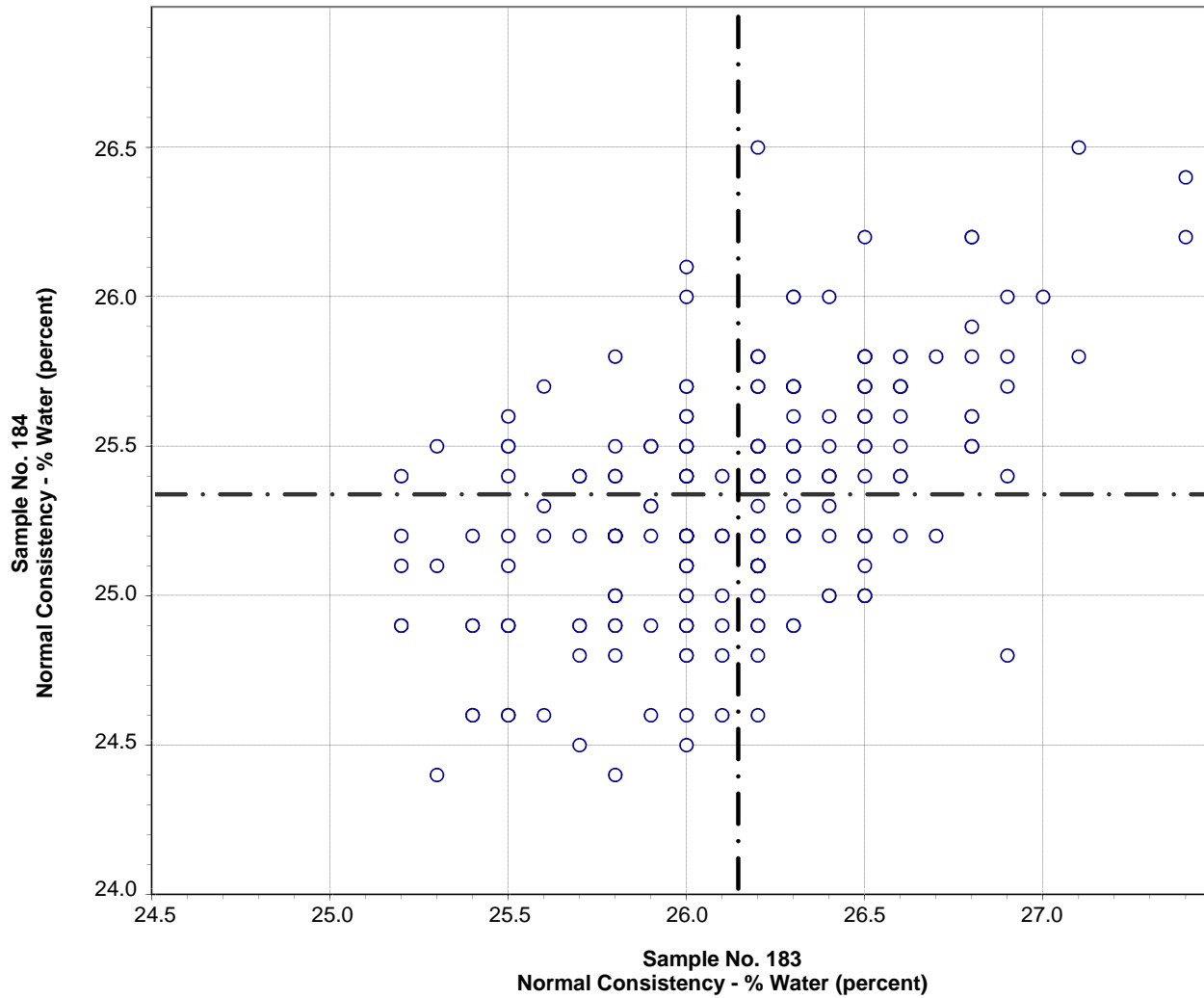
SUMMARY OF RESULTS

Sample No.183

Sample No. 184

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Fineness - Air Permeability (m²/kg)							
	245	398	20	5.0	368	21	5.8
	*230	398	9	2.2	366	9	2.4
* Labs Eliminated - 1, 2, 8, 15, 20, 42, 44, 46, 51, 103, 958, 1483, 1715, 2295, 2305							
Fineness - Wagner Turbidimeter (m²/kg)							
	5	225	15	6.7	207	11	5.5
No Labs Eliminated for This Test							
Fineness - 45µm Sieve (percent)							
	232	98.28	1.09	1.1	95.34	4.15	4.4
	*220	98.41	0.32	0.3	95.70	0.65	0.7
* Labs Eliminated - 1, 2, 95, 203, 206, 254, 1435, 1819, 2352, 2477, 3413, 3658							
C1038 Mortar Bar Expansion (percent)							
	149	0.002	0.018	873	0.004	0.009	206
	*145	0.004	0.003	81	0.005	0.004	78
* Labs Eliminated - 15, 413, 493, 958							
C1038 Mortar - Water (ml)							
	150	241	13	5.5	242	14	5.7
	*144	239	5	2.0	240	5	2.2
* Labs Eliminated - 18, 51, 137, 415, 497, 687							
C1038 Mortar - Flow (percent)							
	150	110	4	3.4	109	4	3.5
	*147	110	3	2.4	110	3	2.4
* Labs Eliminated - 46, 687, 2462							

**CCRL Proficiency Sample Program
Normal Consistency - % Water
PORTLAND CEMENT Samples No. 183 and No. 184**



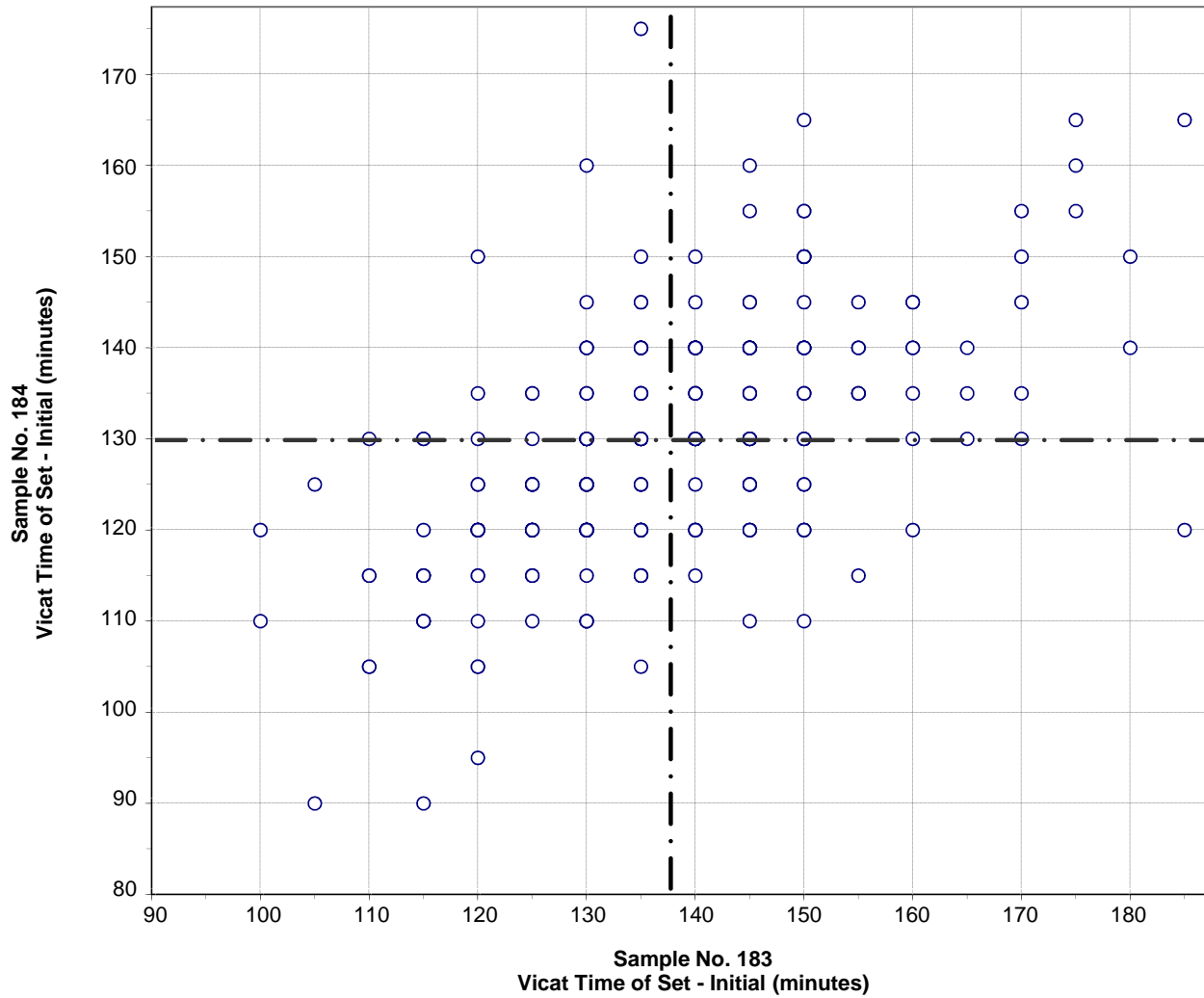
Test No. 110 Normal Consistency - % Water 240 Points

Sample No. 183 Ave 26.1 S.D. 0.41 C.V. 1.60

Sample No. 184 Ave 25.3 S.D. 0.38 C.V. 1.50

Labs Eliminated: 52, 246, 736, 1483, 3057, 3235

**CCRL Proficiency Sample Program
 Vicat Time of Set - Initial
 PORTLAND CEMENT Samples No. 183 and No. 184**

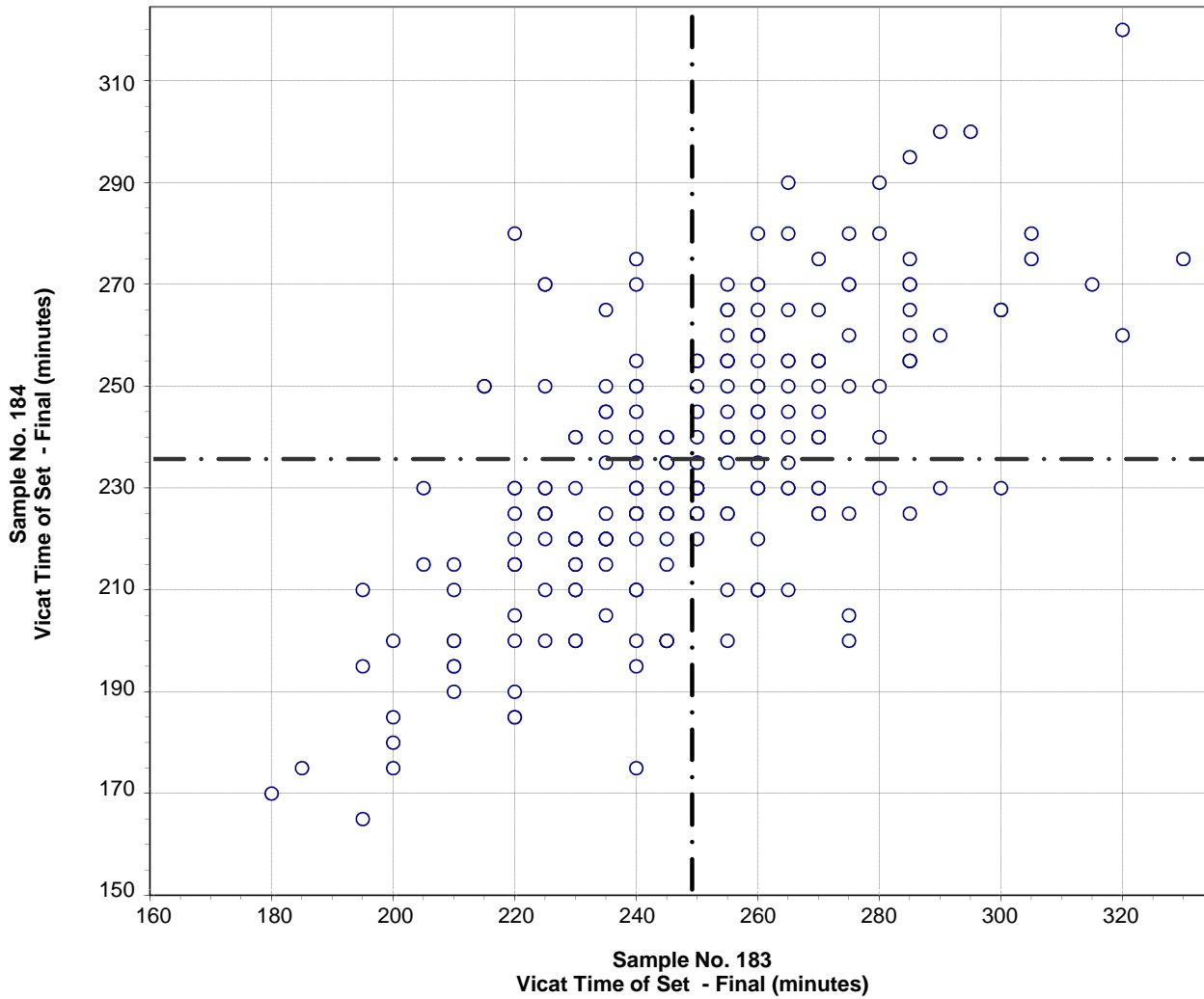


Test No. 120 Vicat Time of Set - Initial 237 Points

Sample No. 183 Ave 138 S.D. 15 C.V. 11
 Sample No. 184 Ave 130 S.D. 13 C.V. 10

Labs Eliminated: 5, 1435, 1483, 3144, 3235

**CCRL Proficiency Sample Program
 Vicat Time of Set - Final
 PORTLAND CEMENT Samples No. 183 and No. 184**



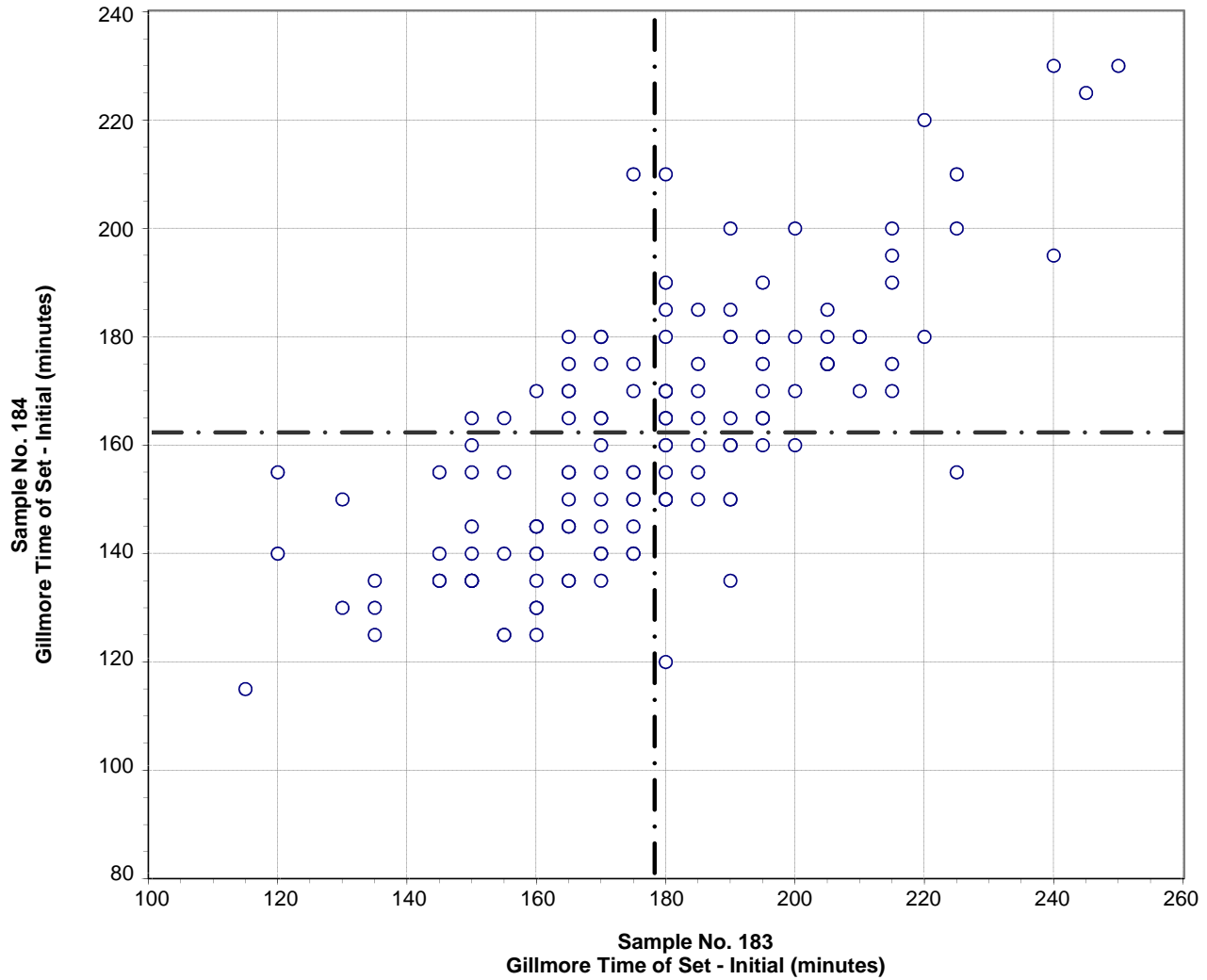
Test No. 121 Vicat Time of Set - Final 228 Points

Sample No. 183 Ave 249 S.D. 26 C.V. 10

Sample No. 184 Ave 235 S.D. 26 C.V. 11

Labs Eliminated: 2, 14, 1251, 2296

**CCRL Proficiency Sample Program
Gillmore Time of Set - Initial
PORTLAND CEMENT Samples No. 183 and No. 184**



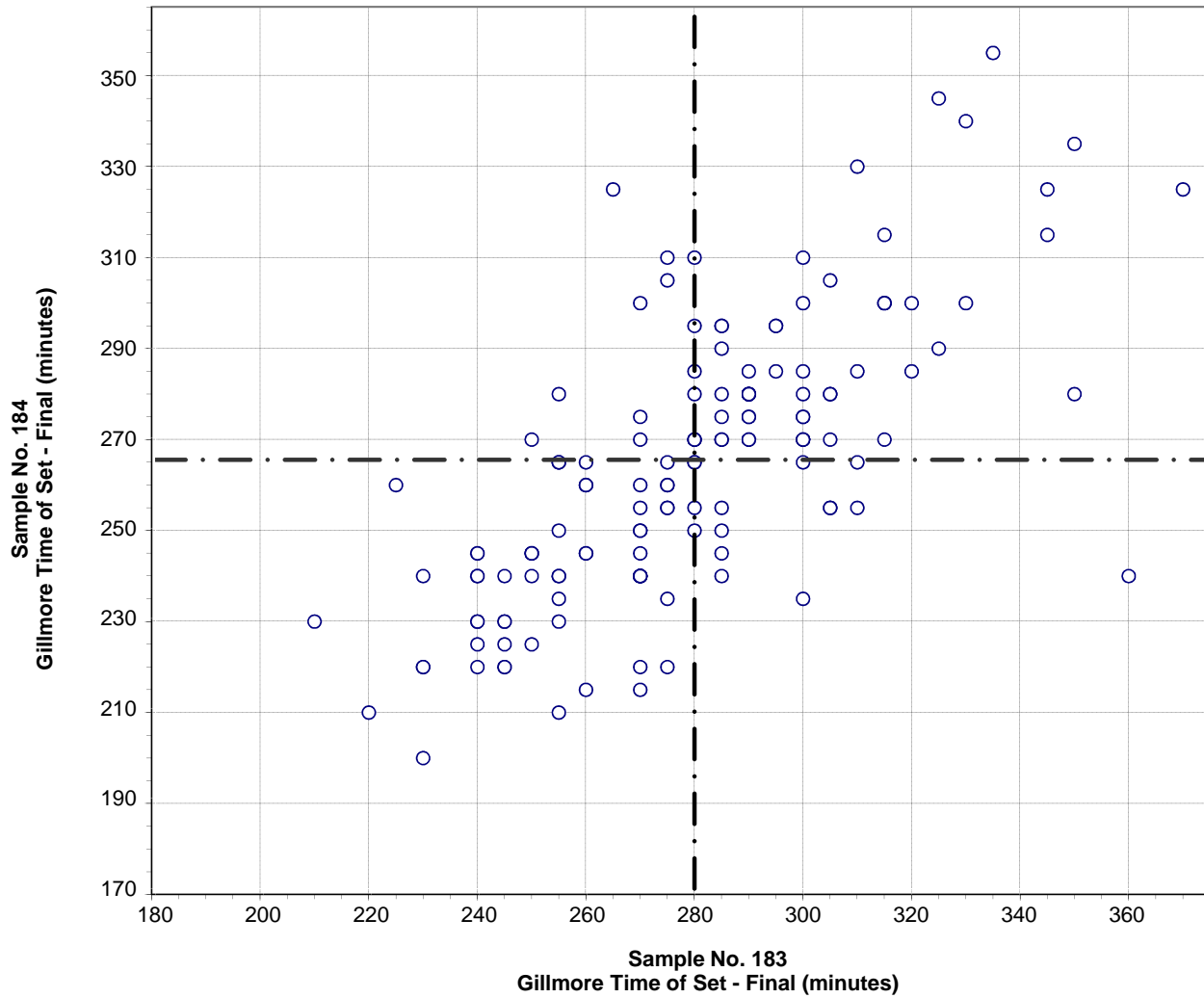
Test No. 130 Gillmore Time of Set - Initial 143 Points

Sample No. 183 Ave 178 S.D. 25 C.V. 14

Sample No. 184 Ave 162 S.D. 23 C.V. 14

Labs Eliminated: 15, 176

**CCRL Proficiency Sample Program
Gillmore Time of Set - Final
PORTLAND CEMENT Samples No. 183 and No. 184**

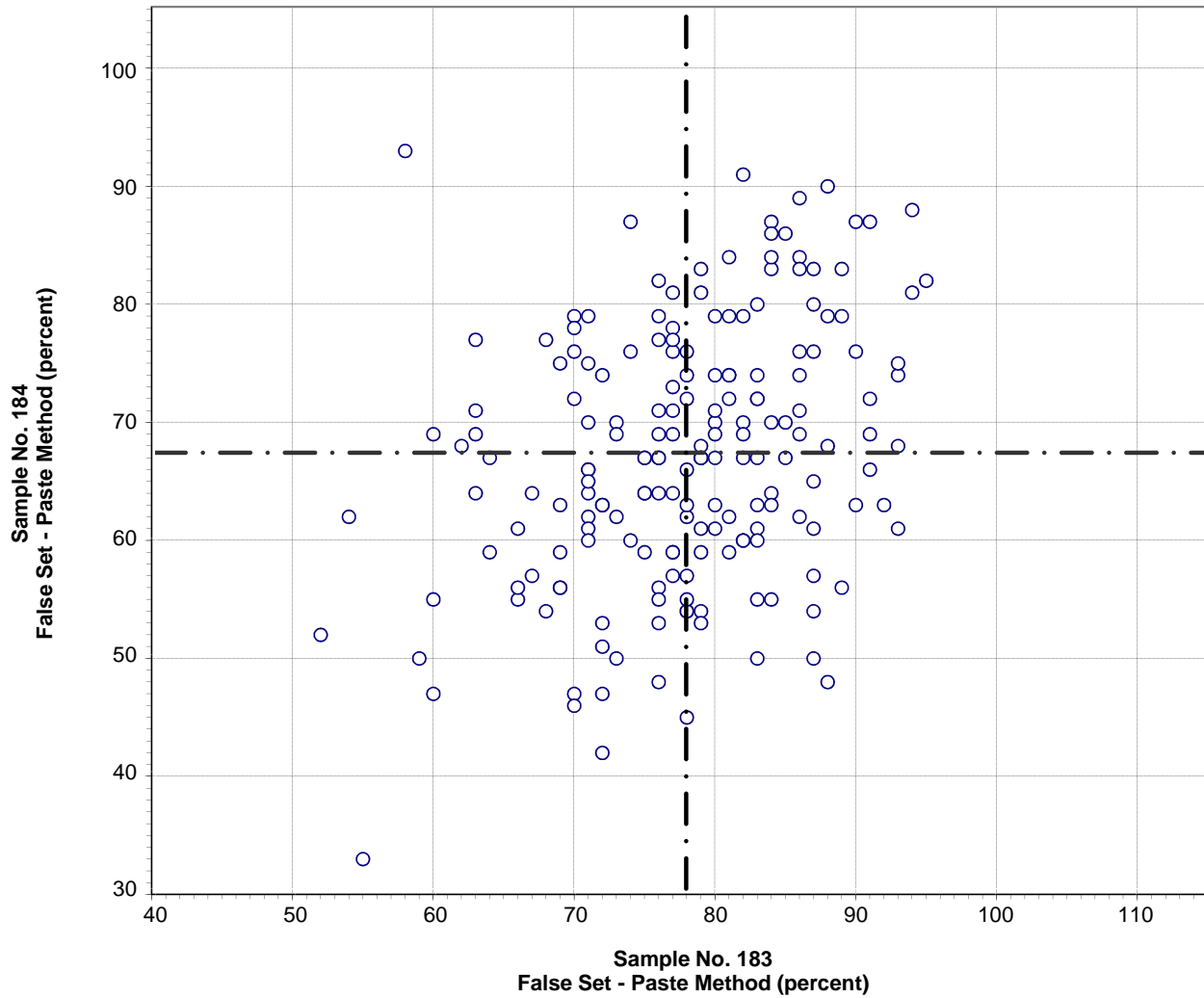


Test No. 140 Gillmore Time of Set - Final 141 Points

Sample No. 183 Ave 280 S.D. 30 C.V. 11
 Sample No. 184 Ave 265 S.D. 31 C.V. 12

Labs Eliminated: 15, 408, 515, 694

**CCRL Proficiency Sample Program
False Set - Paste Method
PORTLAND CEMENT Samples No. 183 and No. 184**

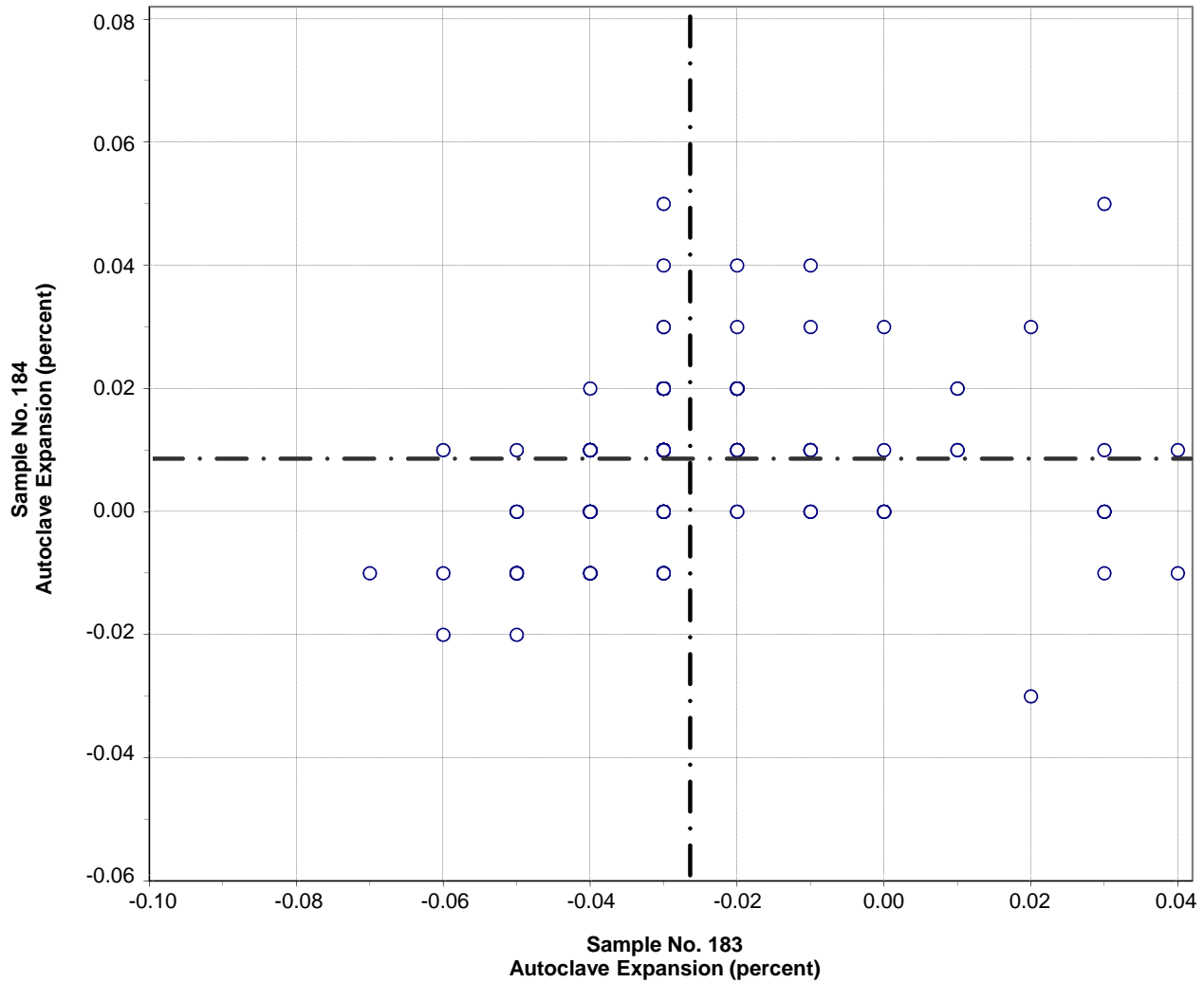


Test No. 150 False Set - Paste Method 187 Points

Sample No. 183 Ave 78 S.D. 8.5 C.V. 11
 Sample No. 184 Ave 67 S.D. 11.1 C.V. 16

Labs Eliminated: 69, 162, 181

**CCRL Proficiency Sample Program
Autoclave Expansion
PORTLAND CEMENT Samples No. 183 and No. 184**

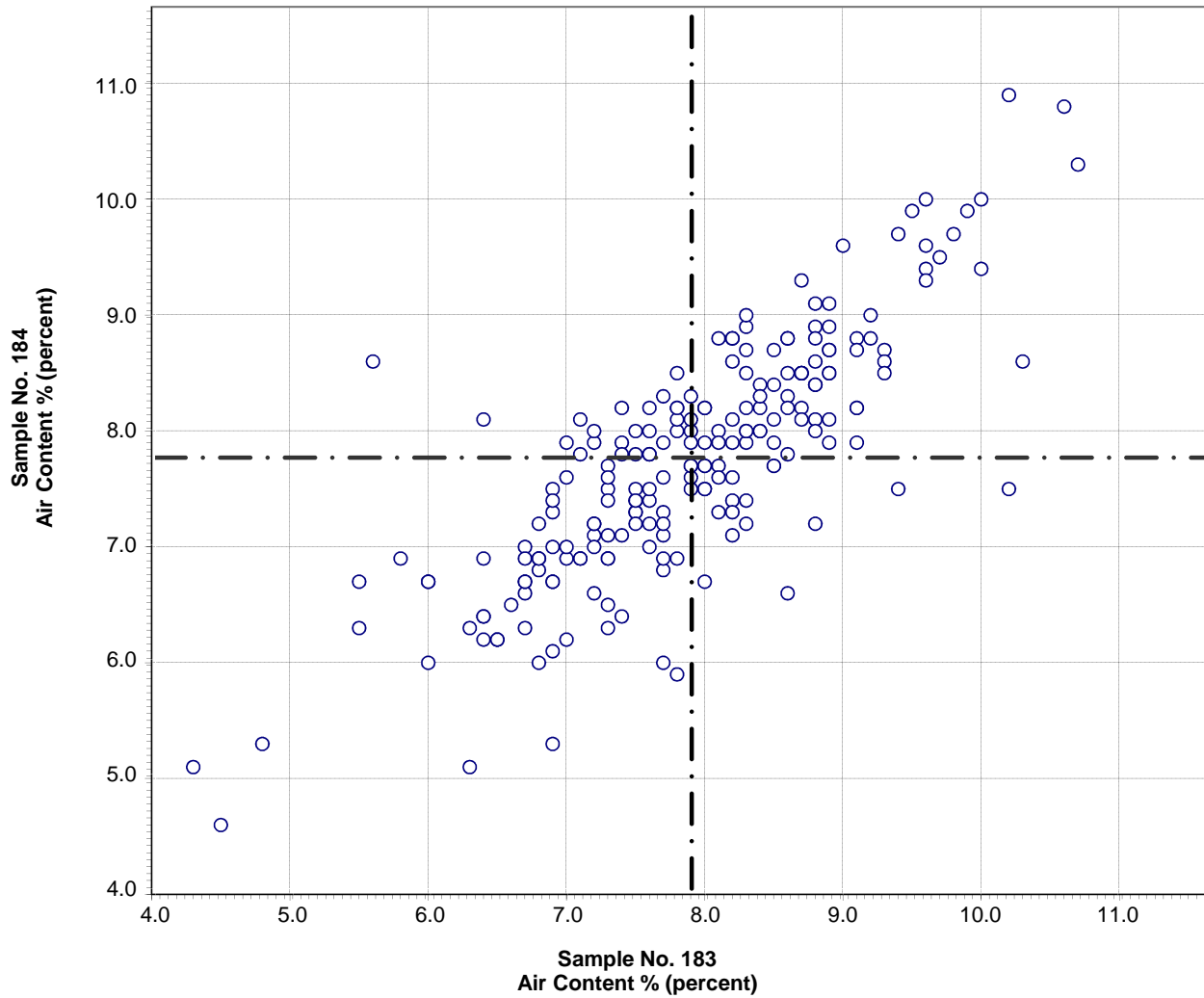


Test No. 160 Autoclave Expansion 205 Points

Sample No. 183 Ave -0.02 S.D. 0.019 C.V. -71
 Sample No. 184 Ave 0.01 S.D. 0.012 C.V. 144

Labs Eliminated: 22, 26, 34, 36, 84, 98, 221, 284, 360, 413, 440, 667, 691, 1054,
 1940, 2254, 3662, 3695

CCRL Proficiency Sample Program
Air Content %
PORTLAND CEMENT Samples No. 183 and No. 184



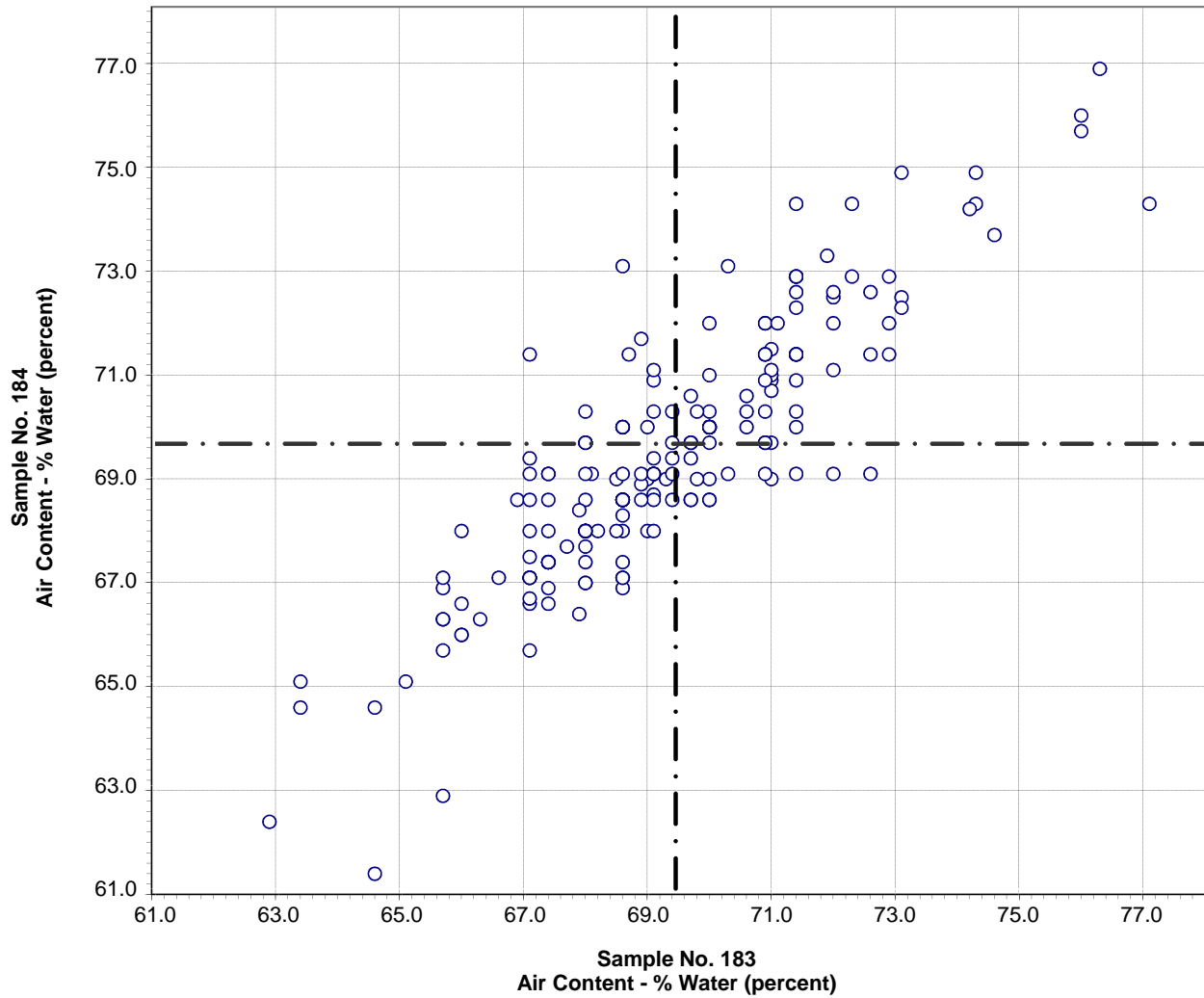
Test No. 170 Air Content % 212 Points

Sample No. 183 Ave 7.9 S.D. 1.1 C.V. 14

Sample No. 184 Ave 7.8 S.D. 1.0 C.V. 13

Labs Eliminated: 6, 18, 360, 2490

CCRL Proficiency Sample Program
Air Content - % Water
PORTLAND CEMENT Samples No. 183 and No. 184



Test No. 180 Air Content - % Water 202 Points

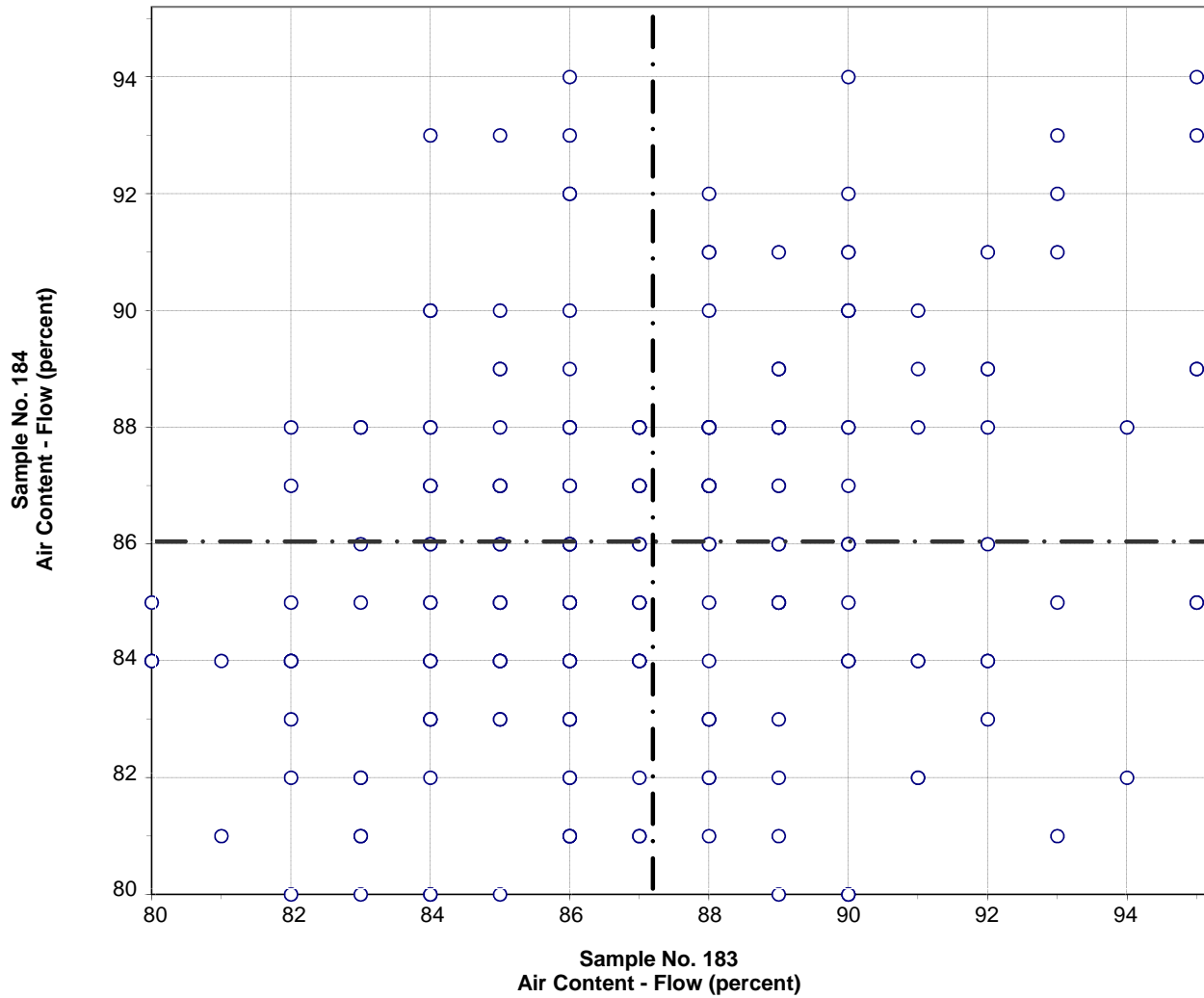
Sample No. 183 Ave 69.4 S.D. 2.6 C.V. 3.7

Sample No. 184 Ave 69.7 S.D. 2.8 C.V. 4.0

Labs Eliminated: 23, 43, 123, 157, 178, 354, 823, 1054

Labs off Diagram: 18, 49, 105, 565, 1053

**CCRL Proficiency Sample Program
Air Content - Flow
PORTLAND CEMENT Samples No. 183 and No. 184**

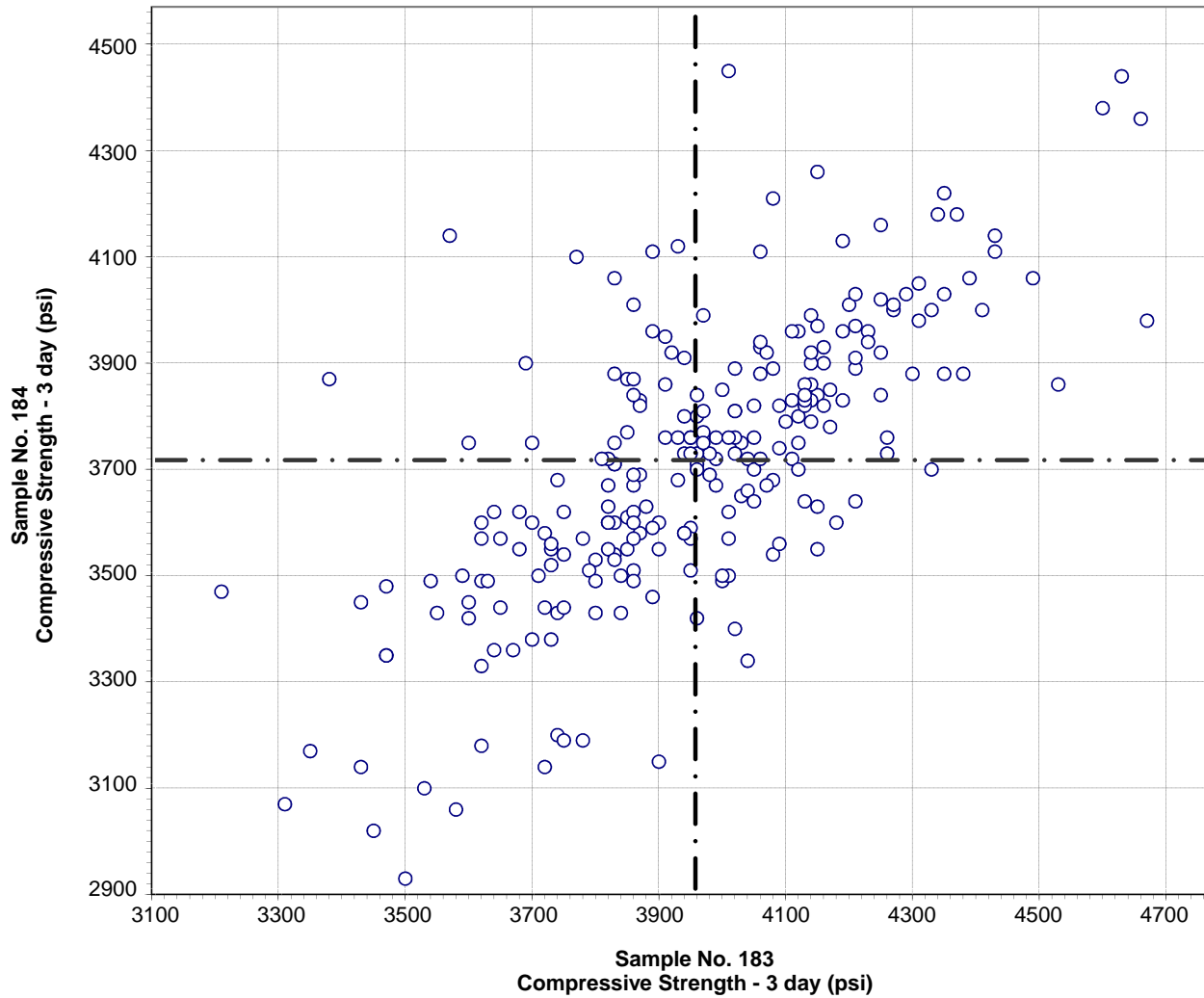


Test No. 190 Air Content - Flow 214 Points

Sample No. 183	Ave 87	S.D. 3.2	C.V. 3.6
Sample No. 184	Ave 86	S.D. 3.2	C.V. 3.8

Labs Eliminated: 142

**CCRL Proficiency Sample Program
Compressive Strength - 3 day
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 200 Compressive Strength - 3 day 244 Points

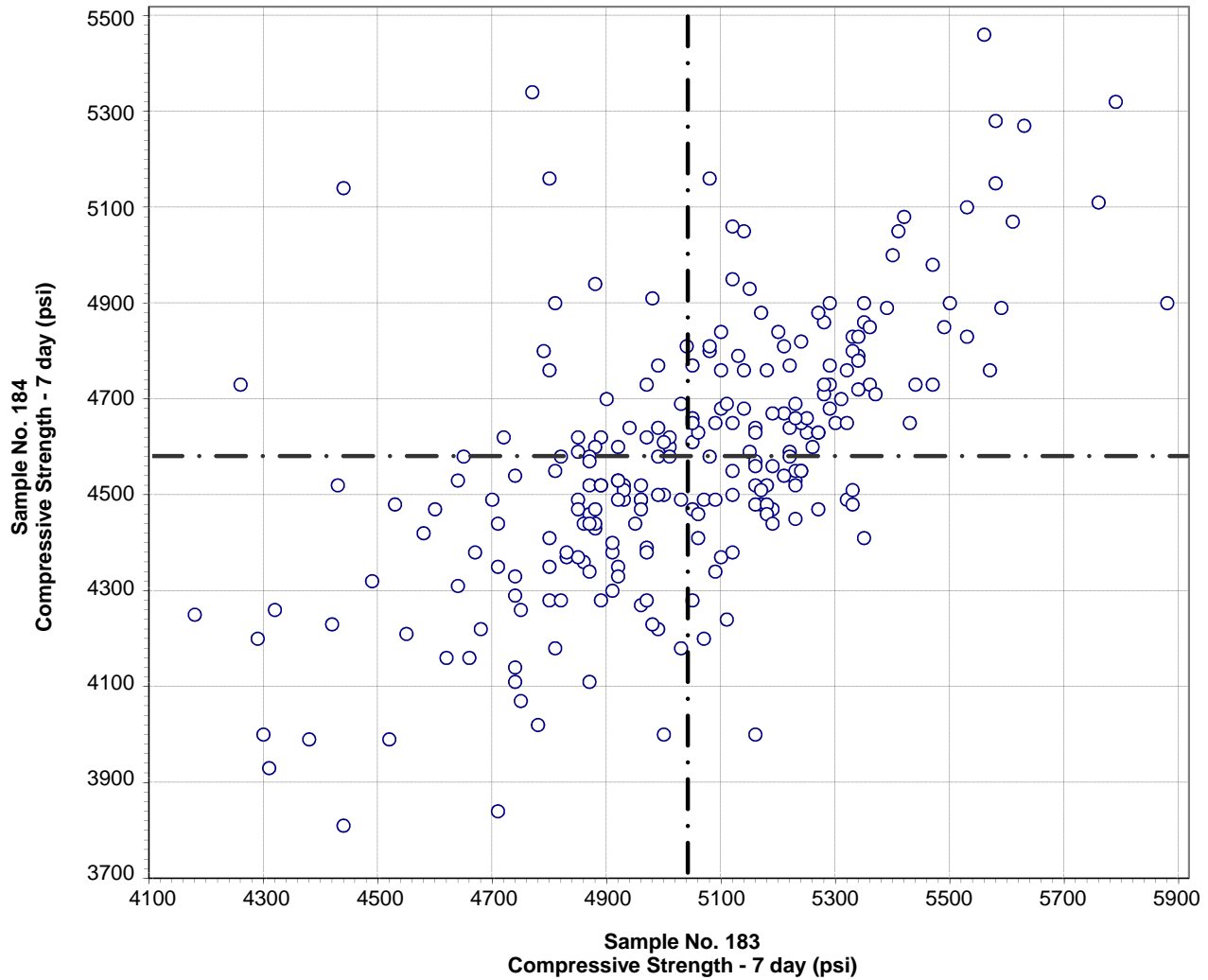
Sample No. 183 Ave 3956 S.D. 253 C.V. 6.4

Sample No. 184 Ave 3714 S.D. 265 C.V. 7.1

Labs Eliminated: 2, 74, 360, 2360, 3135

Labs off Diagram: 515

**CCRL Proficiency Sample Program
Compressive Strength - 7 day
PORTLAND CEMENT Samples No. 183 and No. 184**



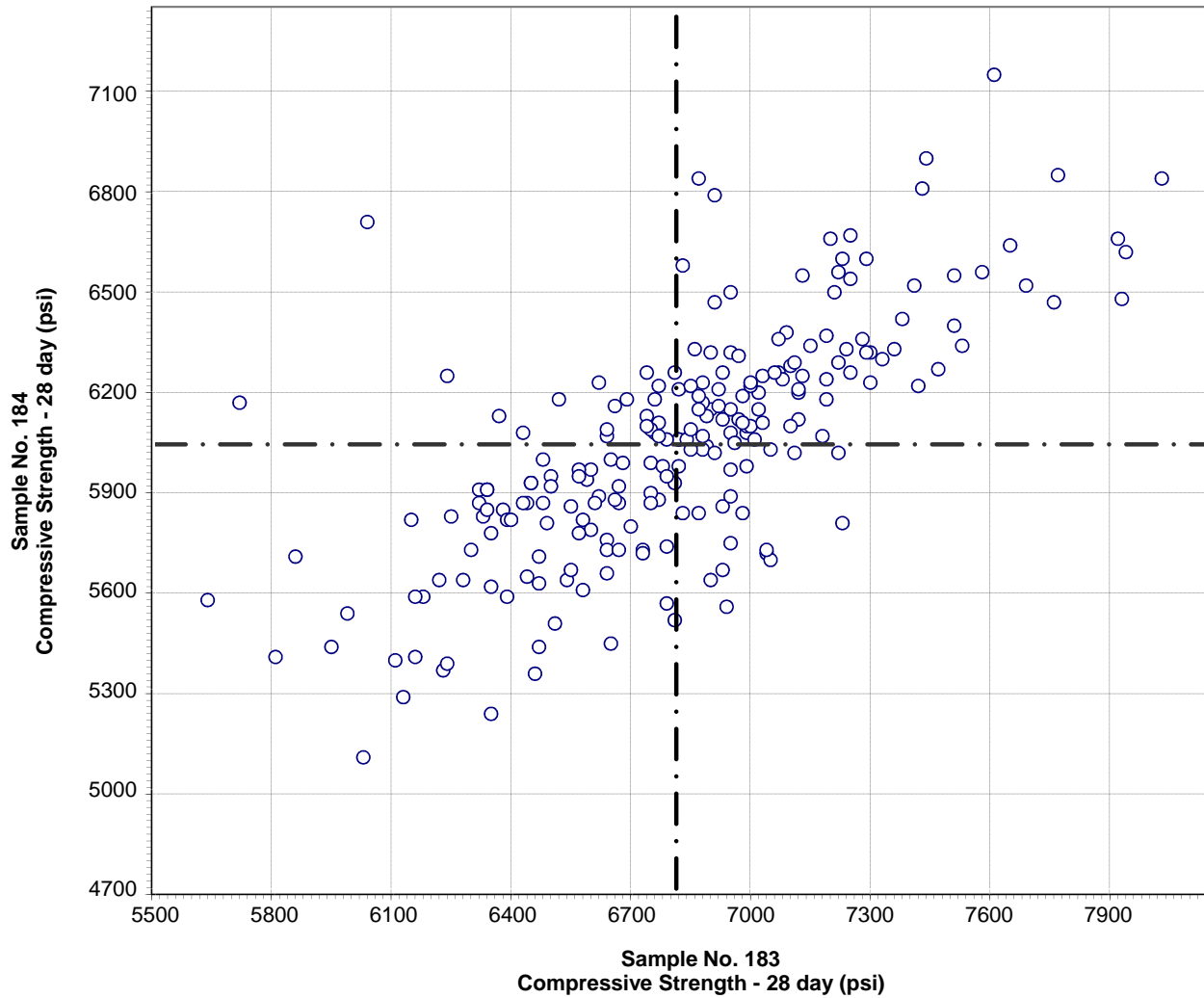
Test No. 210 Compressive Strength - 7 day 243 Points

Sample No. 183 Ave 5040 S.D. 291 C.V. 5.8

Sample No. 184 Ave 4578 S.D. 275 C.V. 6.0

Labs Eliminated: 74, 103, 360, 2360, 3135, 3144, 3297

**CCRL Proficiency Sample Program
Compressive Strength - 28 day
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 211 Compressive Strength - 28 day 222 Points

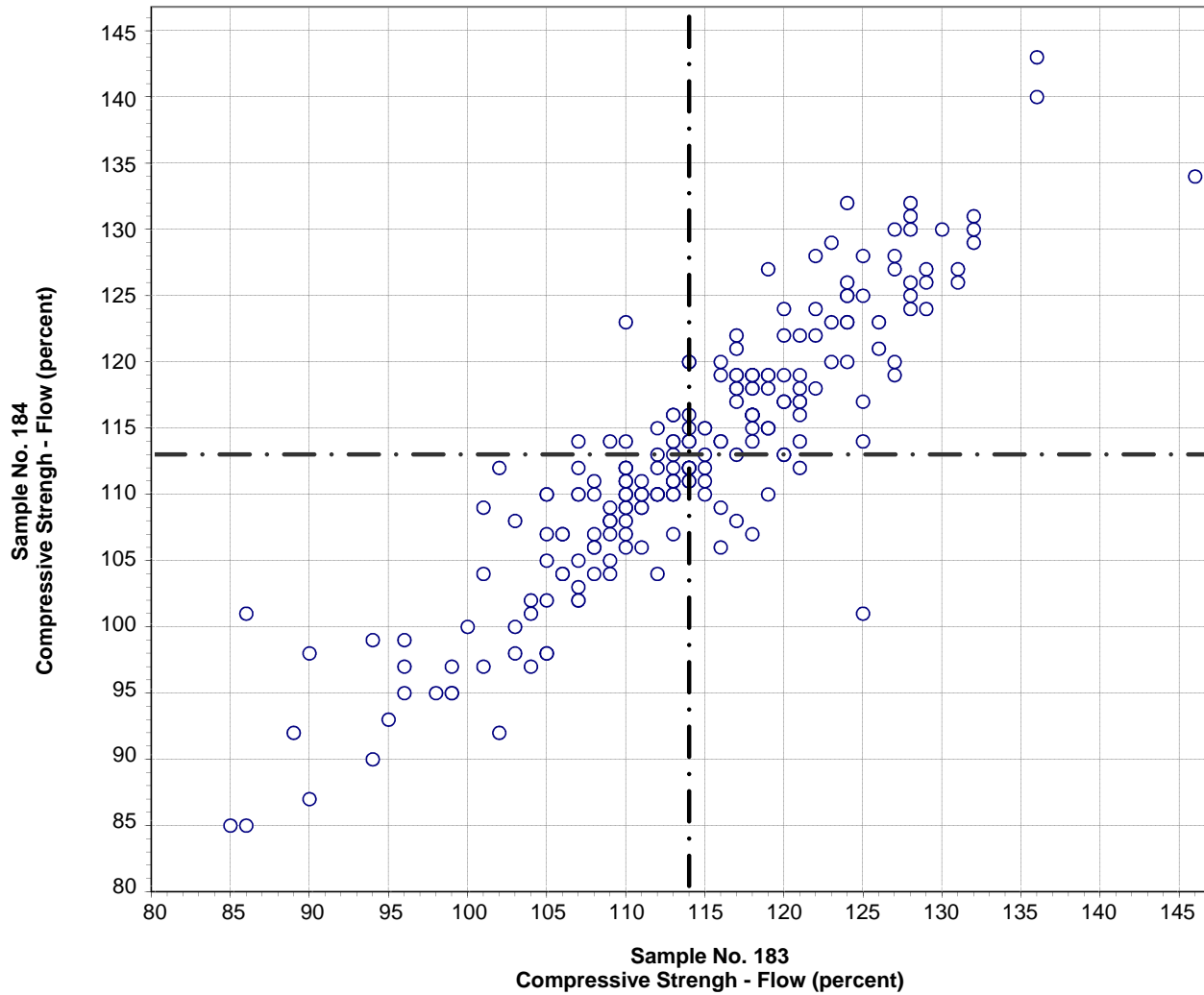
Sample No. 183 Ave 6812 S.D. 434 C.V. 6.4

Sample No. 184 Ave 6041 S.D. 355 C.V. 5.9

Labs Eliminated: 52, 360, 3057, 3144, 3297

Labs off Diagram: 103, 2462

**CCRL Proficiency Sample Program
Compressive Strength - Flow
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 230 Compressive Strength - Flow 223 Points

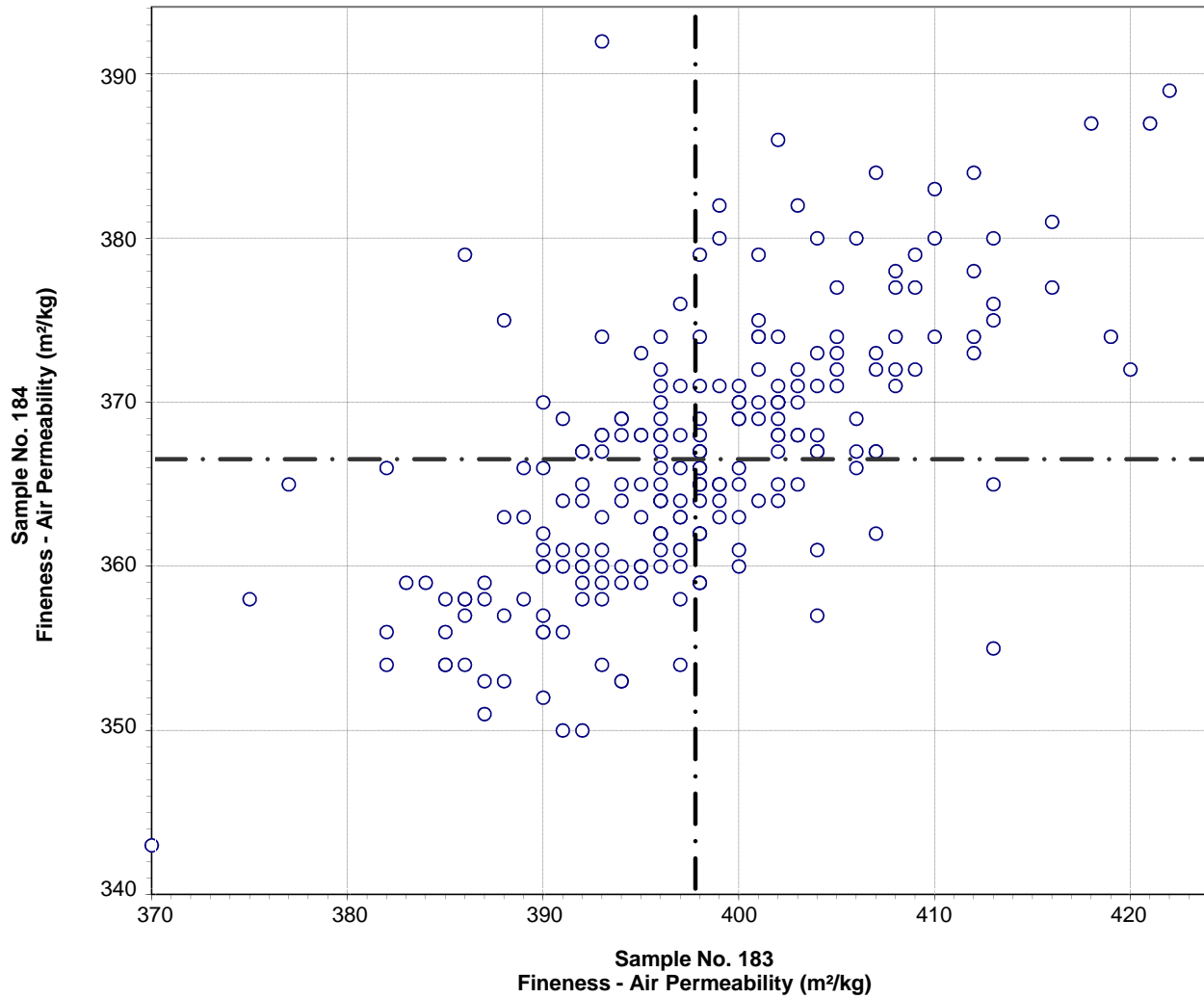
Sample No. 183 Ave 114 S.D. 10 C.V. 8.7

Sample No. 184 Ave 113 S.D. 10 C.V. 8.9

Labs Eliminated: 34, 47, 222, 3695

Labs off Diagram: 2477

**CCRL Proficiency Sample Program
Fineness - Air Permeability
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 270 Fineness - Air Permeability 226 Points

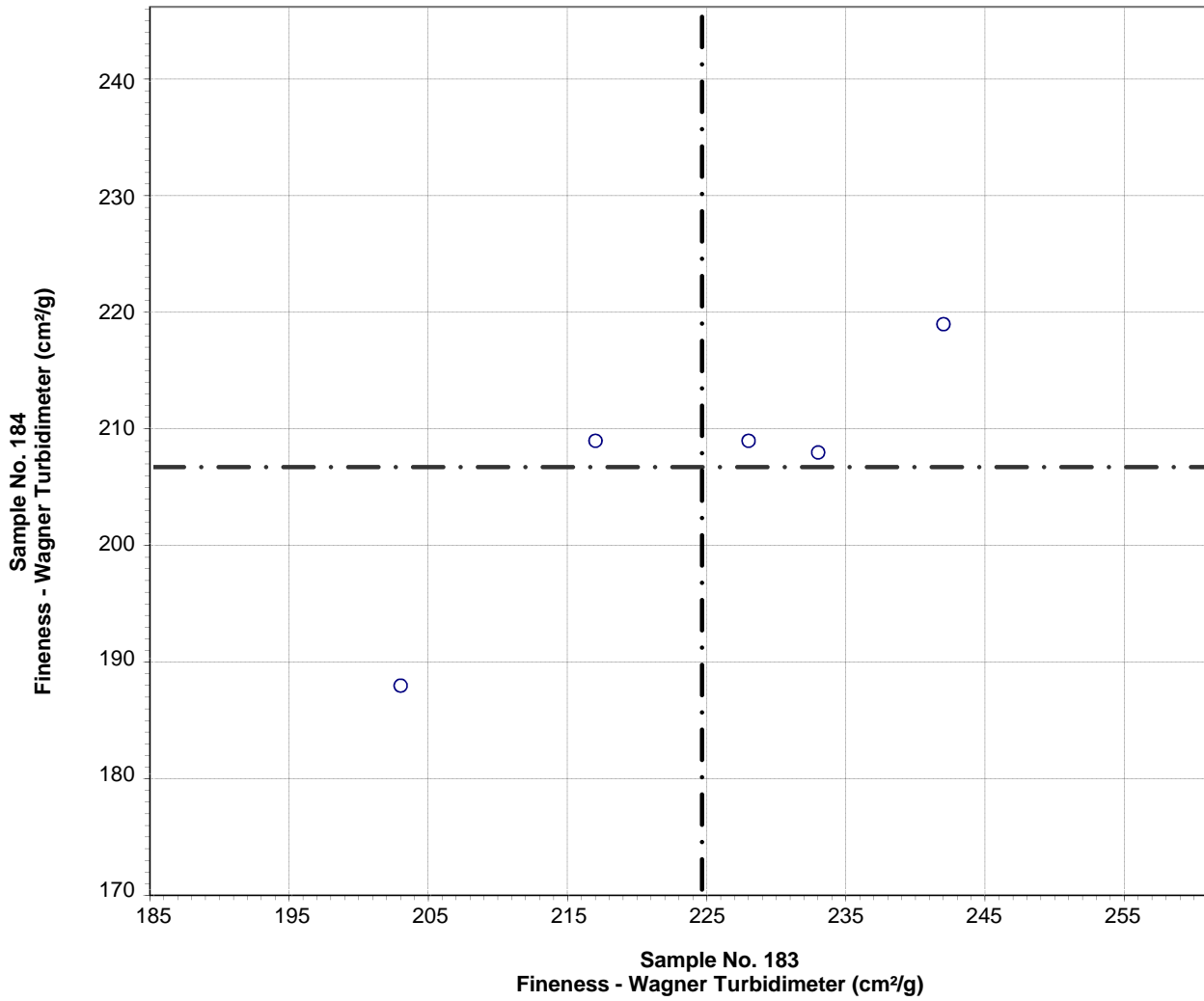
Sample No. 183 Ave 398 S.D. 9 C.V. 2.2

Sample No. 184 Ave 366 S.D. 9 C.V. 2.4

Labs Eliminated: 1, 2, 8, 15, 20, 42, 44, 46, 51, 103, 958, 1483, 1715, 2295, 2305

Labs off Diagram: 25, 207, 494, 823

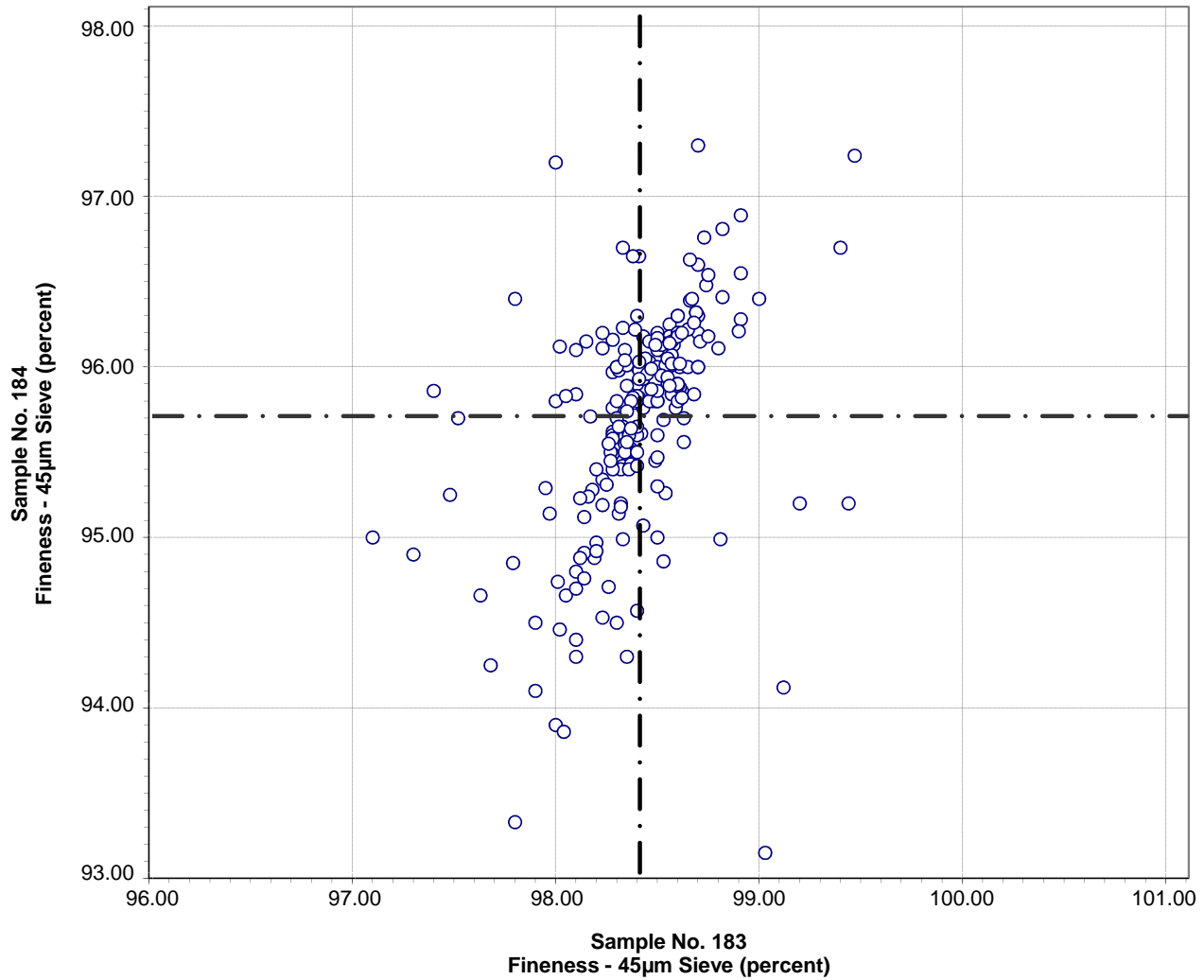
**CCRL Proficiency Sample Program
 Fineness - Wagner Turbidimeter
 PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 280 Fineness - Wagner Turbidimeter 5 Points

Sample No. 183 Ave 225 S.D. 15 C.V. 6.7
 Sample No. 184 Ave 207 S.D. 11 C.V. 5.5

CCRL Proficiency Sample Program
Fineness - 45µm Sieve
PORTLAND CEMENT Samples No. 183 and No. 184



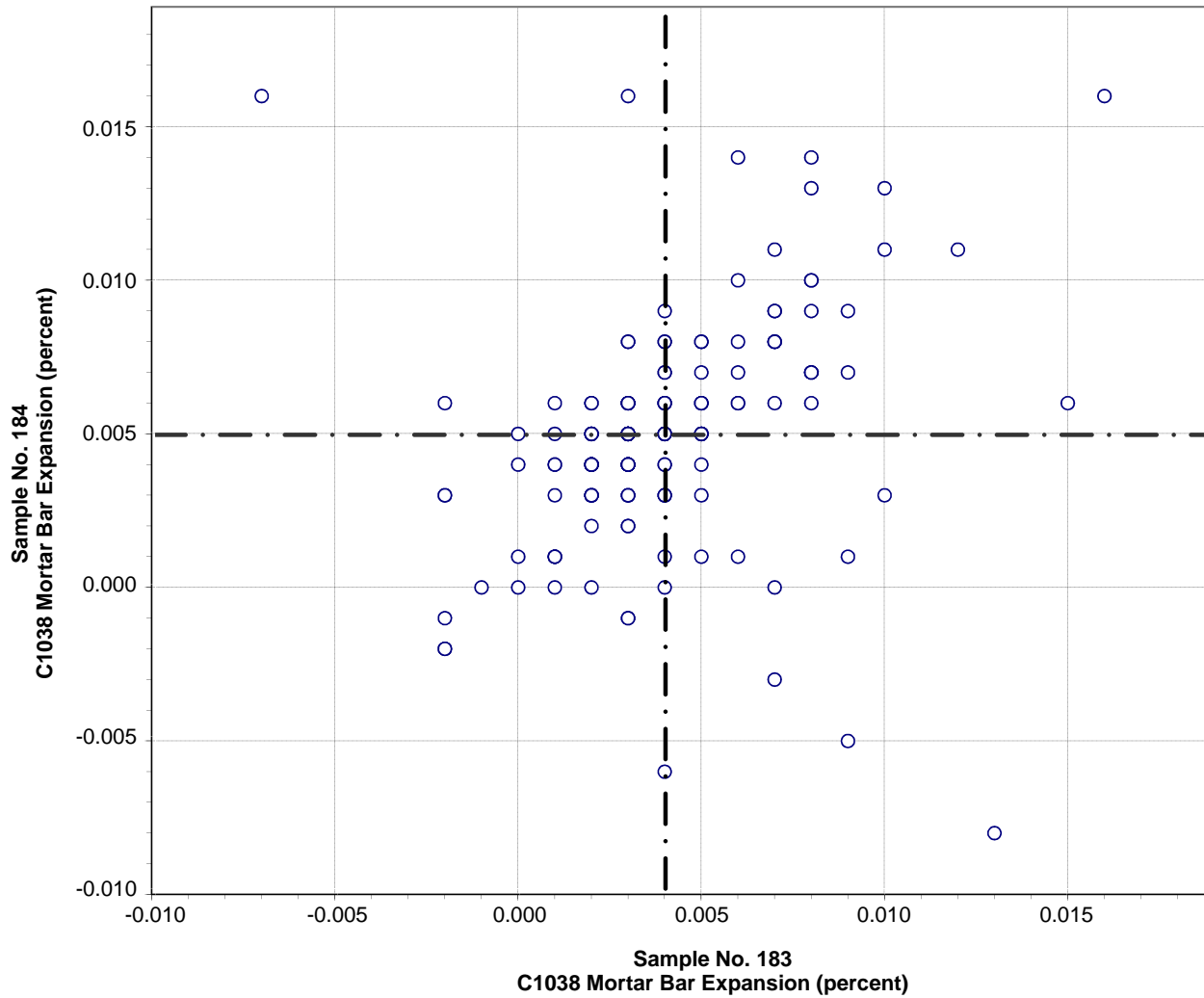
Test No. 281 Fineness - 45µm Sieve 220 Points

Sample No. 183 Ave 98.41 S.D. 0.32 C.V. 0.3

Sample No. 184 Ave 95.70 S.D. 0.65 C.V. 0.7

Labs Eliminated: 1, 2, 95, 203, 206, 254, 1435, 1819, 2352, 2477, 3413, 3658

CCRL Proficiency Sample Program
C1038 Mortar Bar Expansion
PORTLAND CEMENT Samples No. 183 and No. 184

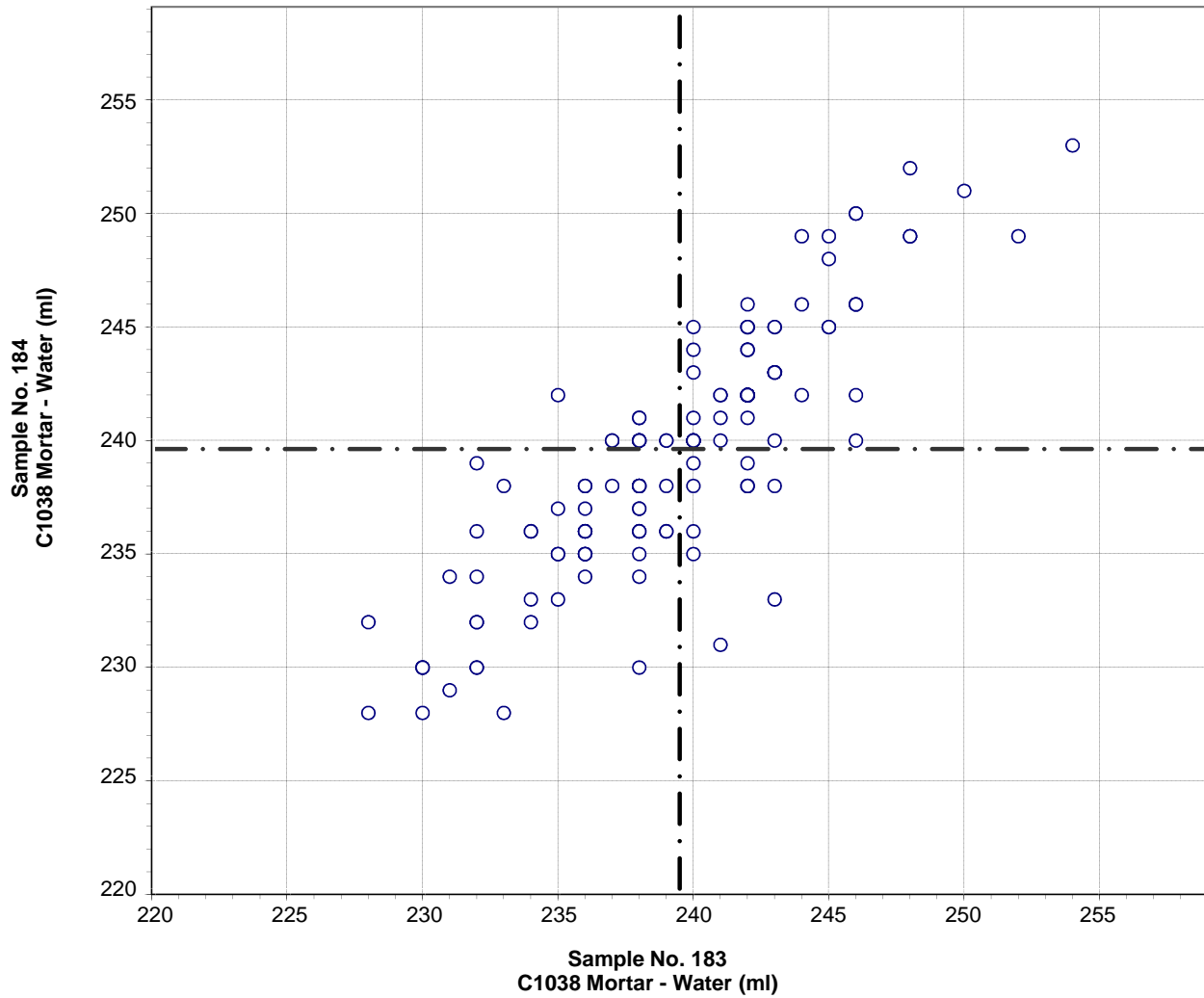


Test No. 400 C1038 Mortar Bar Expansion 145 Points

Sample No. 183 Ave 0.004 S.D. 0.003 C.V. 81
Sample No. 184 Ave 0.005 S.D. 0.004 C.V. 78

Labs Eliminated: 15, 413, 493, 958

**CCRL Proficiency Sample Program
C1038 Mortar - Water
PORTLAND CEMENT Samples No. 183 and No. 184**



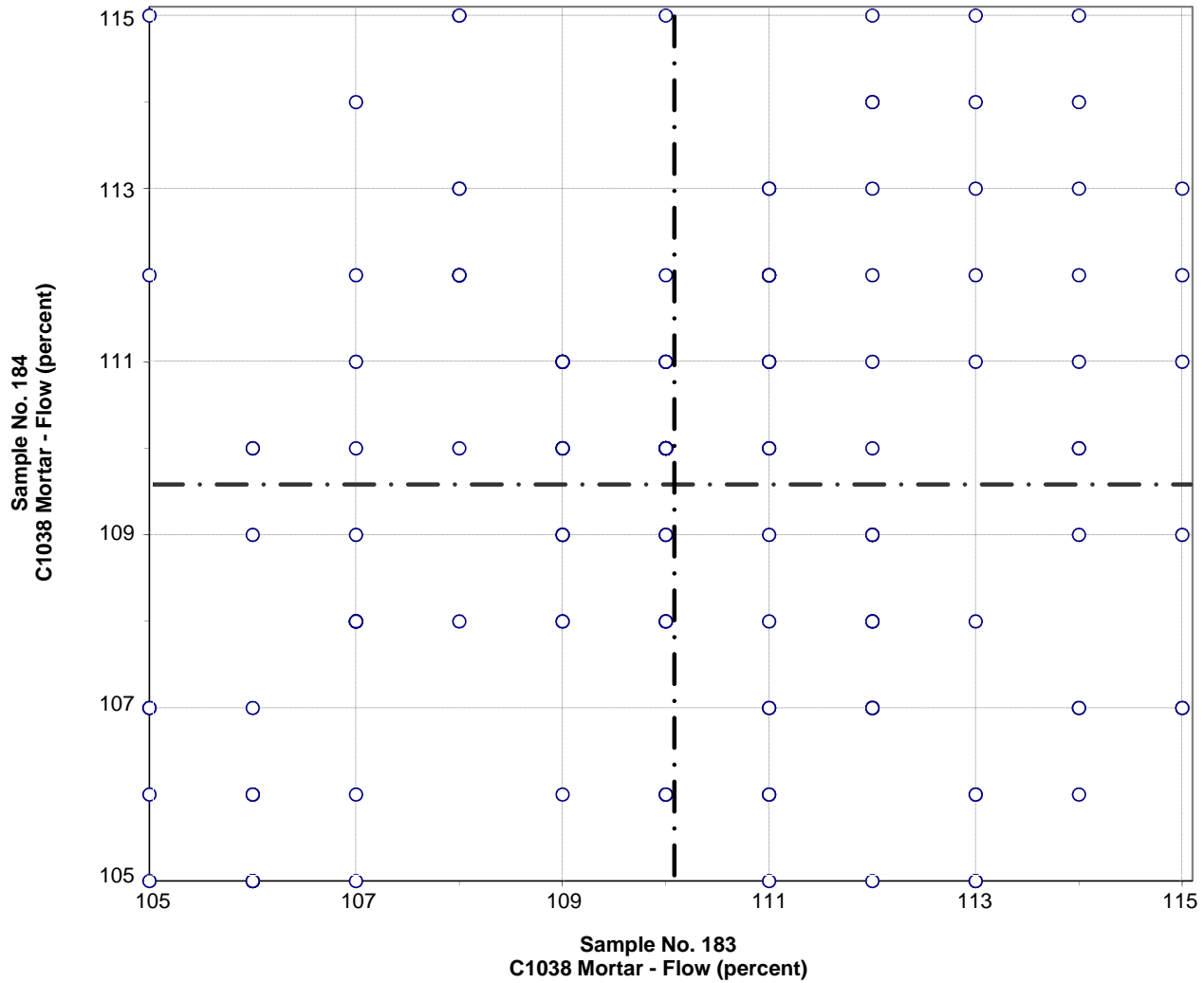
Test No. 401 C1038 Mortar - Water 144 Points

Sample No. 183 Ave 239 S.D. 5 C.V. 2.0

Sample No. 184 Ave 240 S.D. 5 C.V. 2.2

Labs Eliminated: 18, 51, 137, 415, 497, 687

**CCRL Proficiency Sample Program
C1038 Mortar - Flow
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 402 C1038 Mortar - Flow 147 Points

Sample No. 183 Ave 110 S.D. 3 C.V. 2.4

Sample No. 184 Ave 110 S.D. 3 C.V. 2.4

Labs Eliminated: 46, 687, 2462

CCRL PROFICIENCY SAMPLE PROGRAM
 Portland Cement Proficiency Samples No. 183 and No. 184

Final Report – Heat of Hydration Results
 March 23, 2012

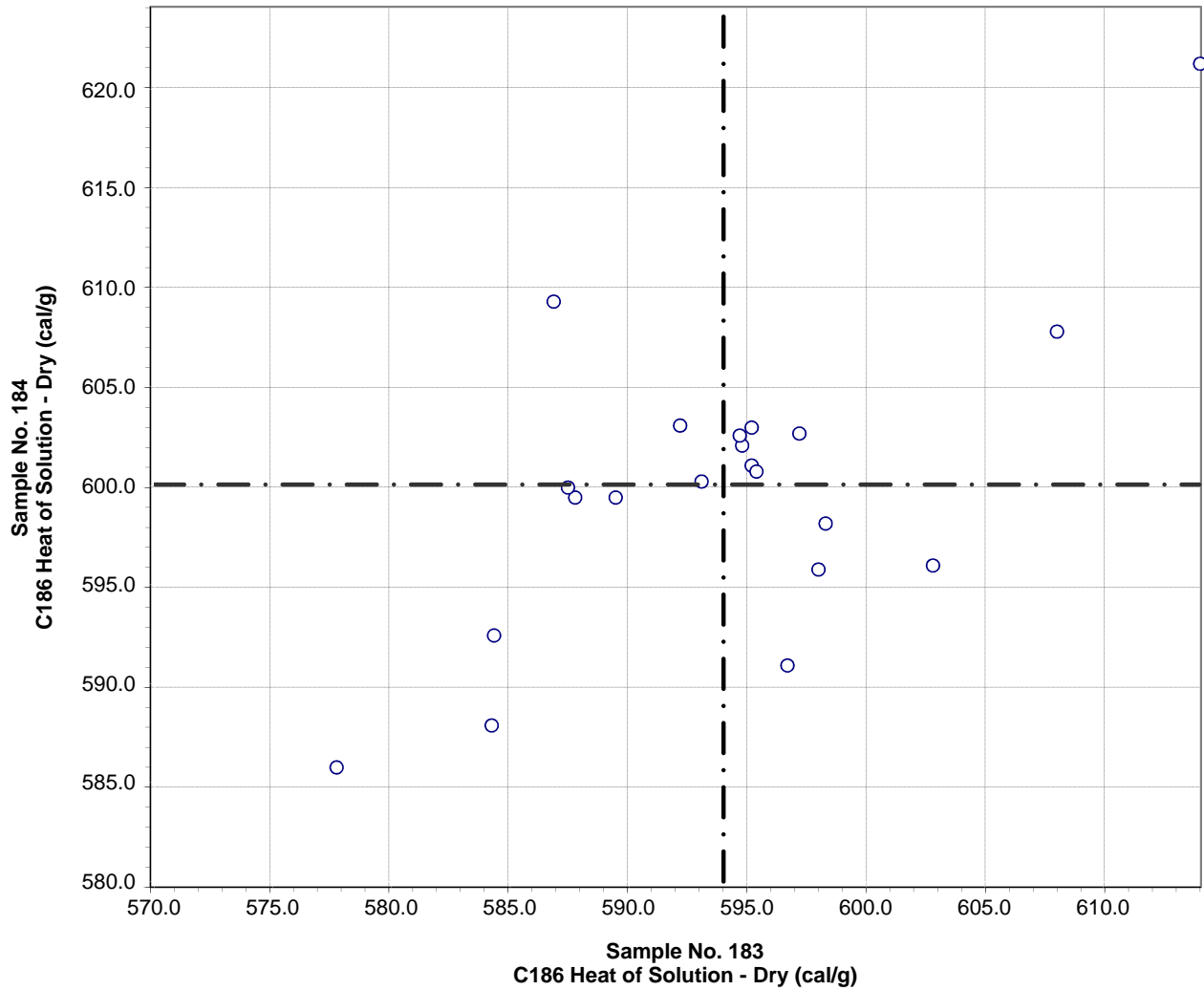
SUMMARY OF RESULTS

Sample No.183

Sample No. 184

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
C186 Heat of Solution - Dry (cal/g)							
	23	590.0	29.6	5.0	596.0	28.6	4.8
	*21	594.0	8.2	1.4	600.0	7.6	1.3
* Labs Eliminated - 2462, 2982							
C186 Heat of Solution - 7 day (cal/g)							
	22	511.6	28.3	5.5	516.1	29.5	5.7
	*19	512.9	7.4	1.5	516.7	9.4	1.8
* Labs Eliminated - 2462, 2982, 3605							
C186 Heat of Solution 28 day (cal/g)							
	17	500.9	30.9	6.2	506.5	37.6	7.4
	*15	504.2	8.6	1.7	511.5	8.2	1.6
* Labs Eliminated - 2254, 2462							
C186 Heat of Hydration - 7 day (cal/g)							
	23	78.6	7.0	9.0	79.9	10.1	12.6
No Labs Eliminated for This Test							
C186 Heat of Hydration - 28 day (cal/g)							
	18	90.8	6.0	6.6	87.9	8.7	9.9
No Labs Eliminated for This Test							
C1702 Heat of Hydration - 3 day (J/g)							
	5	235	96	41.1	255	104	40.9
No Labs Eliminated for This Test							
C1702 Heat of Hydration - 7 day (J/g)							
	6	283	107	37.8	288	108	37.6
No Labs Eliminated for This Test							

**CCRL Proficiency Sample Program
C186 Heat of Solution - Dry
PORTLAND CEMENT Samples No. 183 and No. 184**

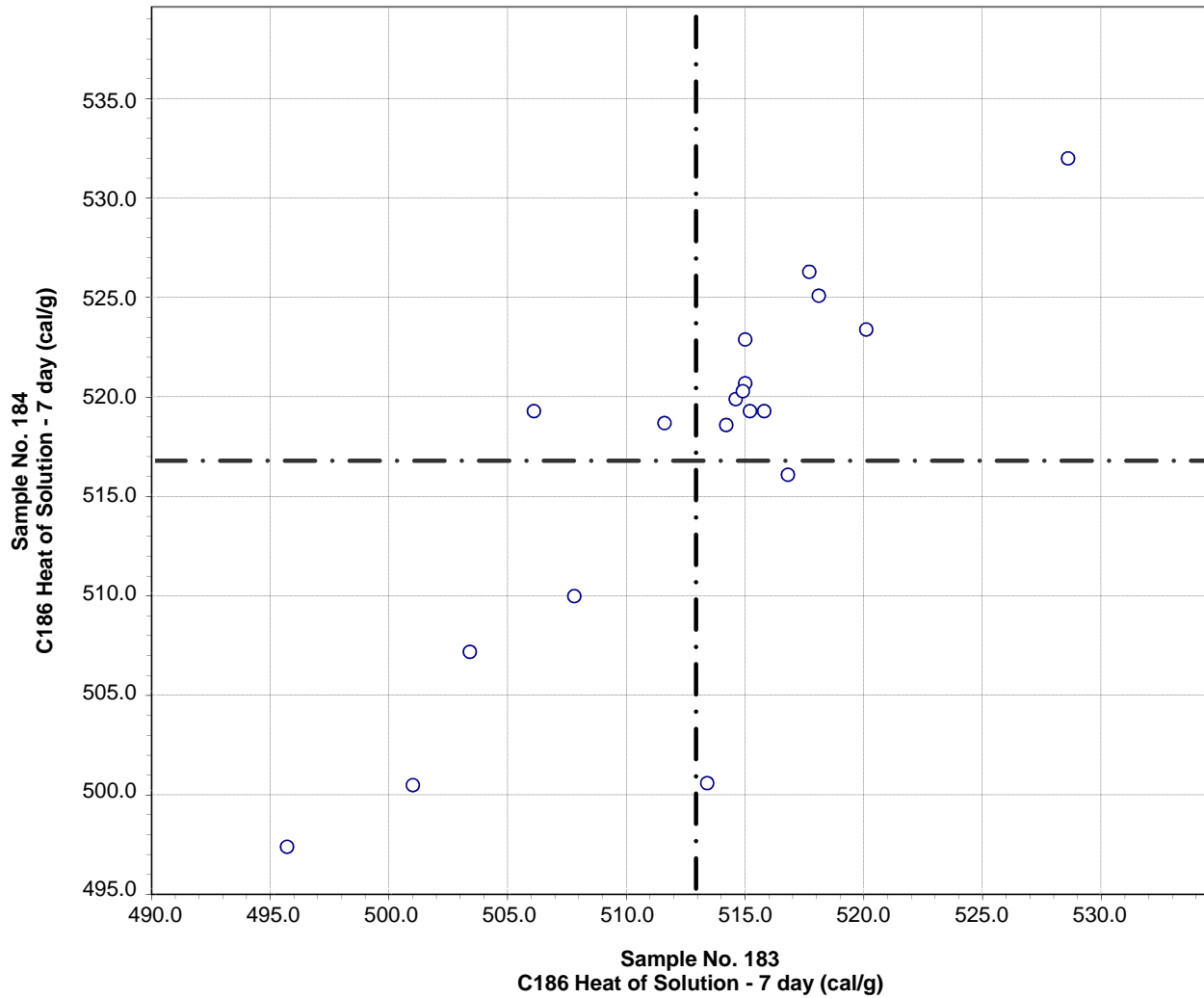


Test No. 291 C186 Heat of Solution - Dry 21 Points

Sample No. 183	Ave 594.0	S.D. 8.2	C.V. 1.4
Sample No. 184	Ave 600.0	S.D. 7.6	C.V. 1.3

Labs Eliminated: 2462, 2982

**CCRL Proficiency Sample Program
C186 Heat of Solution - 7 day
PORTLAND CEMENT Samples No. 183 and No. 184**



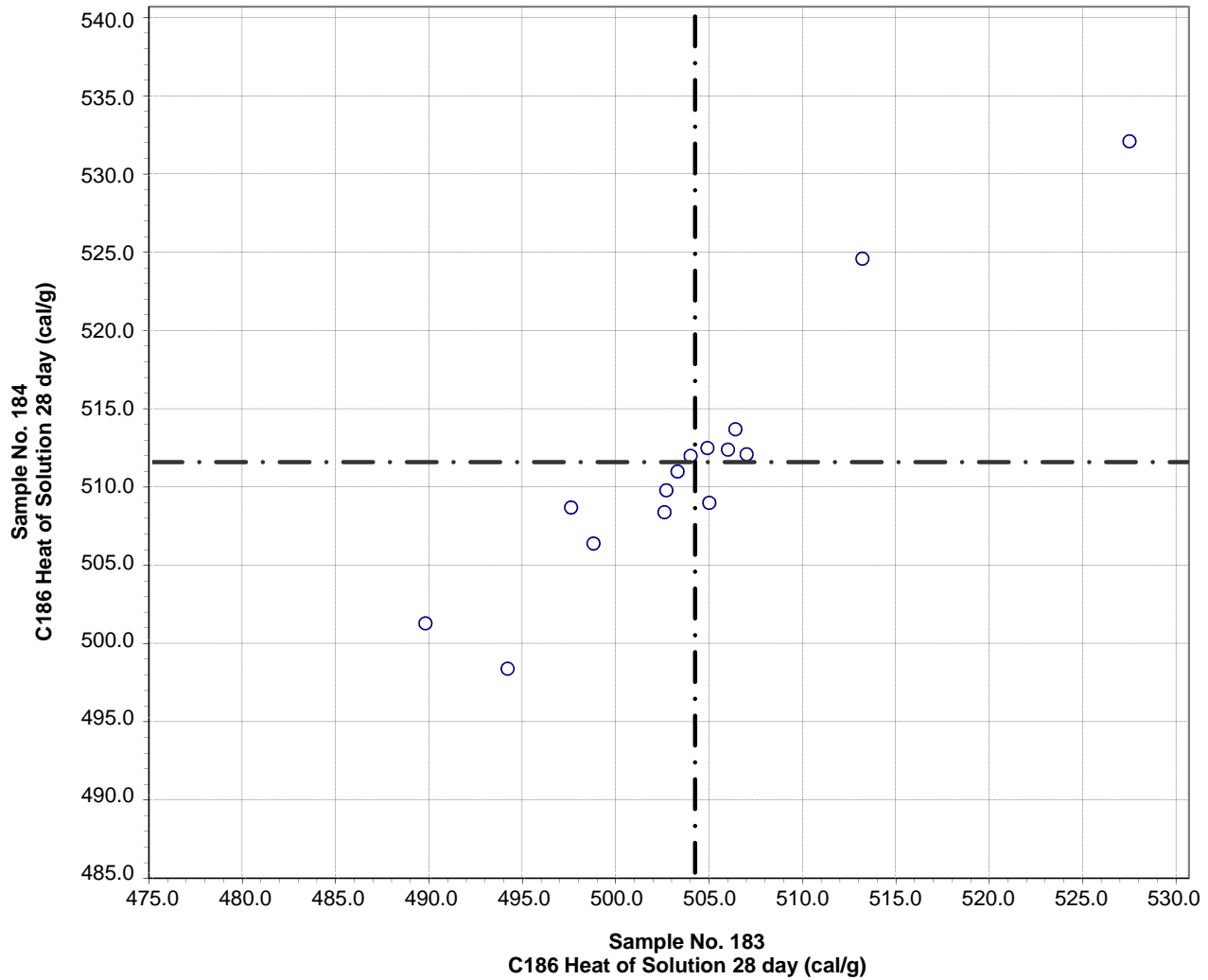
Test No. 292 C186 Heat of Solution - 7 day 19 Points

Sample No. 183 Ave 512.9 S.D. 7.4 C.V. 1.5

Sample No. 184 Ave 516.7 S.D. 9.4 C.V. 1.8

Labs Eliminated: 2462, 2982, 3605

CCRL Proficiency Sample Program
C186 Heat of Solution 28 day
PORTLAND CEMENT Samples No. 183 and No. 184

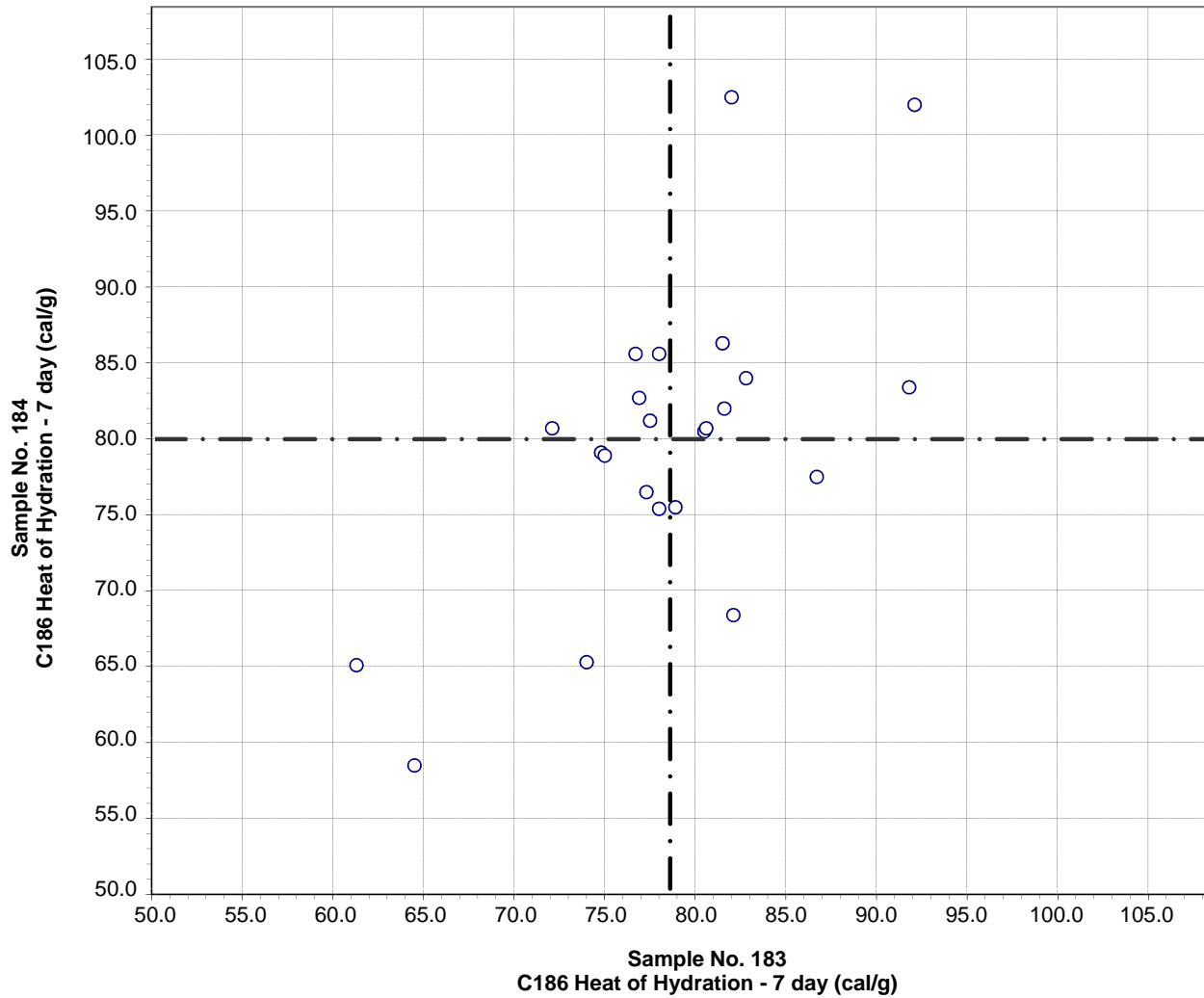


Test No. 301 C186 Heat of Solution 28 day 15 Points

Sample No. 183 Ave 504.2 S.D. 8.6 C.V. 1.7
Sample No. 184 Ave 511.5 S.D. 8.2 C.V. 1.6

Labs Eliminated: 2254, 2462

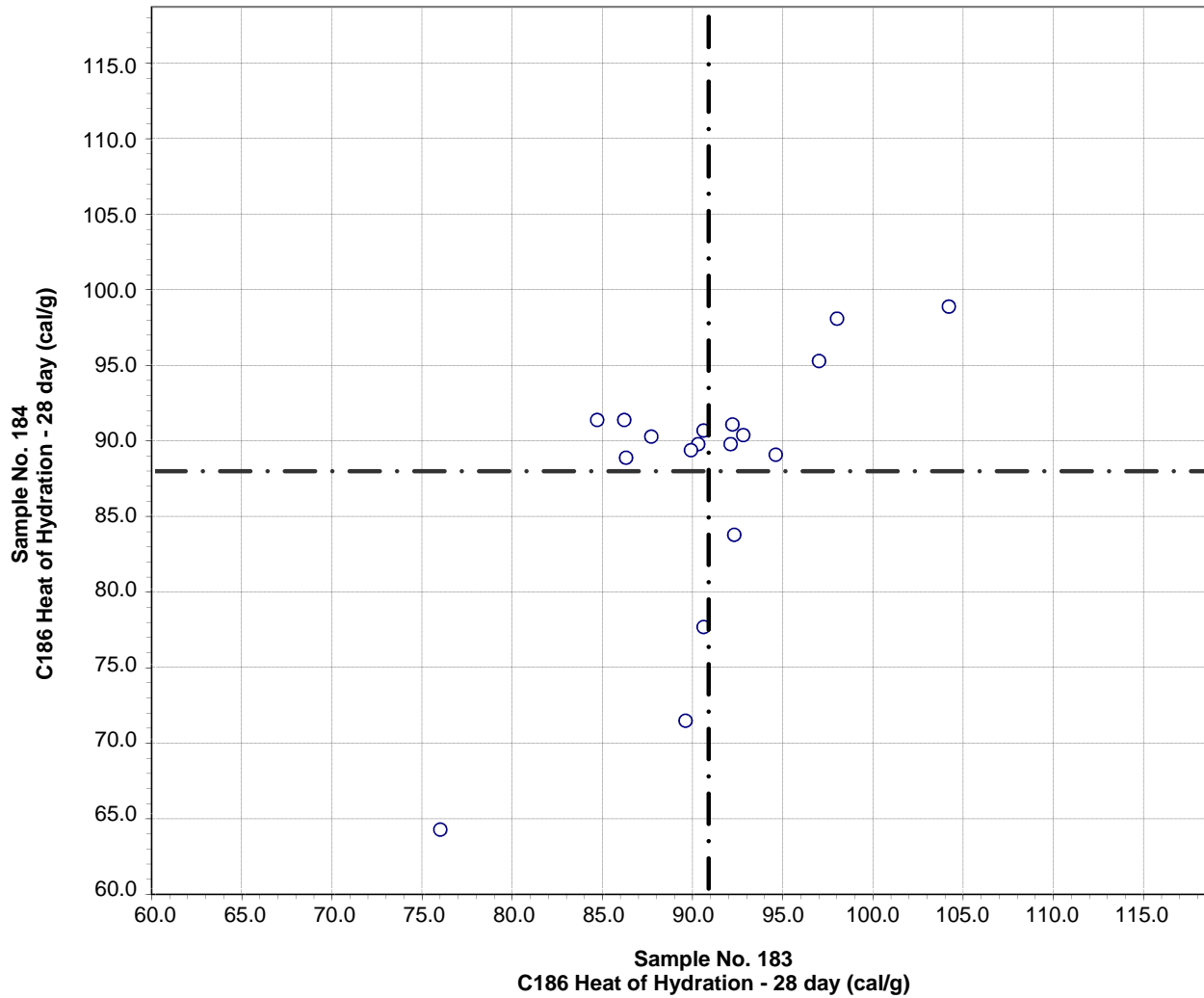
**CCRL Proficiency Sample Program
C186 Heat of Hydration - 7 day
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 290 C186 Heat of Hydration - 7 day 23 Points

Sample No. 183	Ave 78.6	S.D. 7.0	C.V. 9.0
Sample No. 184	Ave 79.9	S.D. 10.1	C.V. 12.6

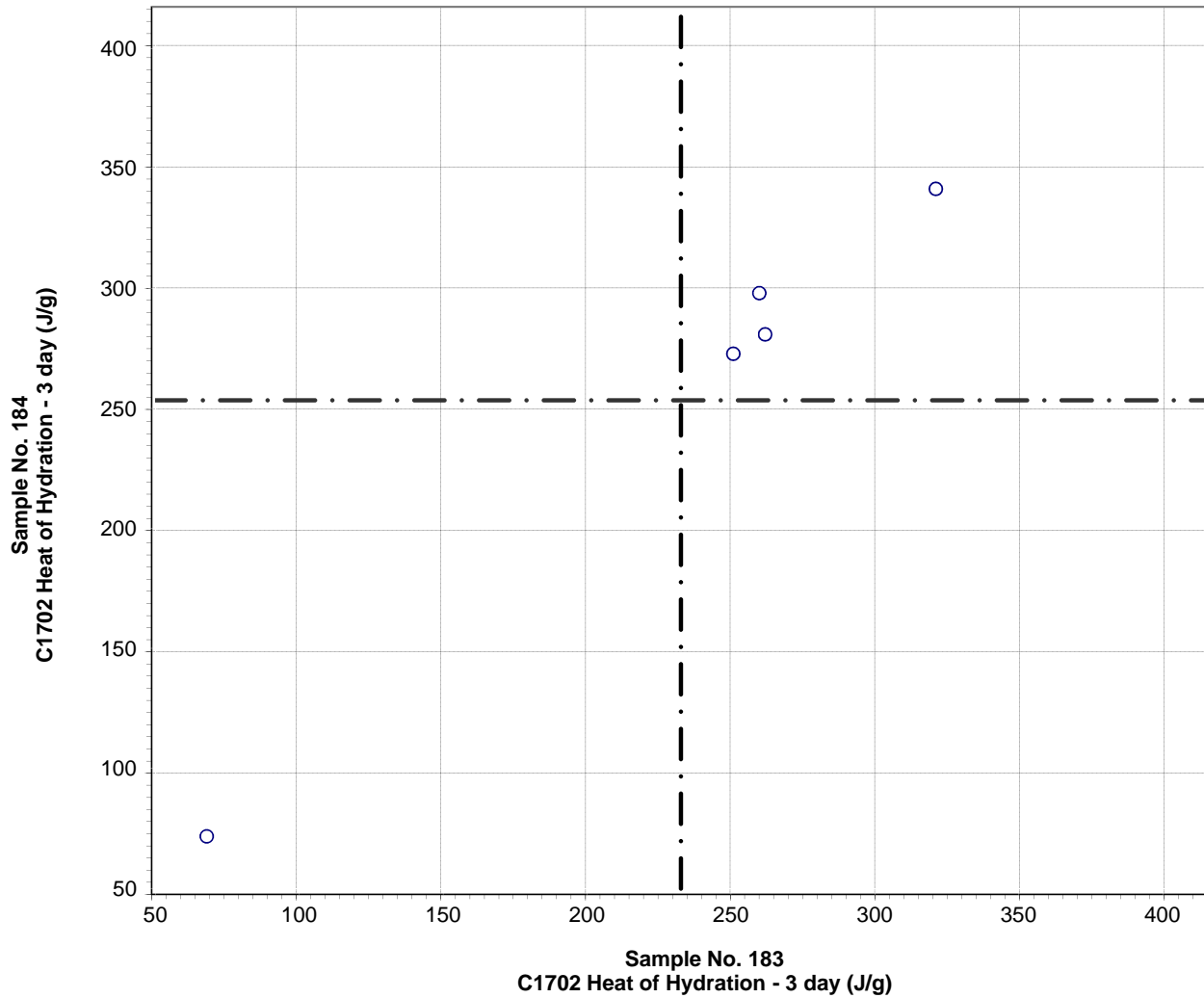
**CCRL Proficiency Sample Program
C186 Heat of Hydration - 28 day
PORTLAND CEMENT Samples No. 183 and No. 184**



Test No. 300 C186 Heat of Hydration - 28 day 18 Points

Sample No. 183	Ave 90.8	S.D. 6.0	C.V. 6.6
Sample No. 184	Ave 87.9	S.D. 8.7	C.V. 9.9

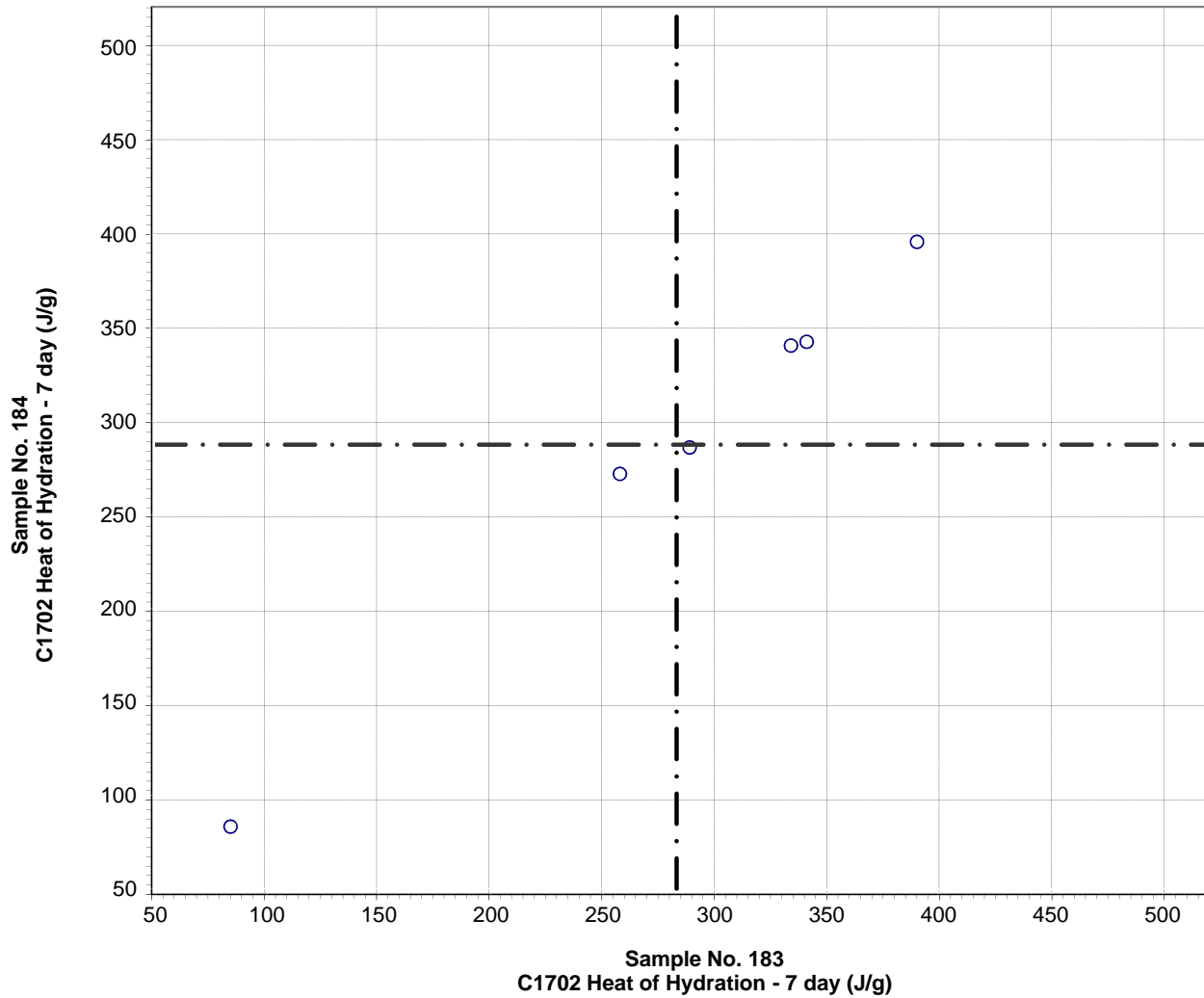
CCRL Proficiency Sample Program
C1702 Heat of Hydration - 3 day
PORTLAND CEMENT Samples No. 183 and No. 184



Test No. 500 C1702 Heat of Hydration - 3 day 5 Points

Sample No. 183 Ave 235 S.D. 96 C.V. 41
Sample No. 184 Ave 255 S.D. 104 C.V. 41

CCRL Proficiency Sample Program
C1702 Heat of Hydration - 7 day
PORTLAND CEMENT Samples No. 183 and No. 184



Test No. 510 C1702 Heat of Hydration - 7 day 6 Points

Sample No. 183	Ave 283	S.D. 107	C.V. 37.8
Sample No. 184	Ave 288	S.D. 108	C.V. 37.6