

capillaries of the instrument. In some embodiments, a run is stopped, paused, pressure is increased or decreased, warning signals sent, or one or more various other actions taken if measured pressure parameters indicate run quality might be compromised based on pressure.

[0007] In some embodiments, one or more current noise metrics are determined based on current measurements during a sample run. In some embodiments, actions are taken during a sample run if predetermined current noise metrics are exceeded.

[0008] That existing calibration methods require a separate runtime operation of an instrument is disruptive to the user and reduces productivity. This can also lead to calibration not being done often enough to ensure optimal results. Embodiments of the present invention provide instruments, computer systems, computer program products, and methods for automatic correction of spectral error during the instrument's normal runtime operation without requiring the user to conduct a special, separate calibration run. In other words, in certain embodiments, an end user does not have to perform a separate manual spectral calibration, making this a calibration-less instrument from an end user's perspective. In other embodiments, the need to perform separate runtime or pre-run calibrations is reduced by the use of in-run calibration or other correction of spectral error.

[0008a] According to an embodiment, a method comprises providing a sample containing one or more biological molecules; performing a process or assay on the sample; while performing the process or assay, detecting the one or more biological molecules within a detection zone; before or during detecting, measuring two or more parameters associated with the process or assay; performing an action based on one or more measured values of the two or more parameters; providing a data structure comprising one or more values corresponding to at least one of the two or more parameters; and during or after detecting, modifying the data structure based on the one or more measured values to provide an updated data structure; wherein the action is based on the updated data structure; and wherein the two or more parameters comprises two or more of: a parameter indicative of a sensed value of a pressure associated the process or assay, a parameter indicative of a sensed value of a spectrum of at least one biological molecule within the detection zone, a parameter indicative

of a sensed value of a temperature associated the process or assay, and a parameter indicative of a current associated with a medium carrying the at least one biological molecule.

[0008b] According to another embodiment, a method comprises providing a sample solution containing one or more biological sample molecules; performing a process or assay on the sample solution; while performing the process or assay, detecting the one or more biological molecules; before or during detecting, measuring a first system parameter; before or during detecting, measuring a second system parameter; performing an analysis on at least some measurements of at least one of the first system parameter and the second system parameter; and before or during detecting, performing an action based on the analysis, wherein performing the action is based on the first system parameter or the second system parameter having a value that is outside a predetermined range a plurality of different times during the process.

[0008c] There is also disclosed a system for use in analyzing dye-labeled samples, the system comprising a sample processing instrument; a processor; and a memory encoded with instructions for carrying out the analysis steps as described above.

[0008d] There is also disclosed system for use in analyzing dye-labeled samples, the system comprising a sample separation instrument; a processor; and a memory encoded with instructions for carrying out the analysis steps as described above.

[0008e] There is also disclosed a system for use in analyzing dye-labeled samples, the system comprising a capillary electrophoresis instrument comprising a plurality of capillaries; a processor; and a memory encoded with instructions for carrying out the analysis steps as described above.

[0009] Various other aspects of the inventive subject matter will become more apparent from the following description, along with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 illustrates a sample separation and identification instrument in accordance with an embodiment of the present invention.

[0011] FIG. 2 illustrates an exemplary method in accordance with an embodiment of the invention to carry out runtime correction of spectral error in the instrument of FIG. 1.

[0012] FIG. 3 illustrates an exemplary method in accordance with an embodiment of the invention to carry out runtime correction of spectral error in the instrument of FIG. 1.

CLAIMS

1. A method comprising:
 - providing a sample containing one or more biological molecules;
 - performing a process or assay on the sample;
 - while performing the process or assay, detecting the one or more biological molecules within a detection zone;
 - before or during detecting, measuring two or more parameters associated with the process or assay;
 - performing an action based on one or more measured values of the two or more parameters;
 - providing a data structure comprising one or more values corresponding to at least one of the two or more parameters; and
 - during or after detecting, modifying the data structure based on the one or more measured values to provide an updated data structure;
 - wherein the action is based on the updated data structure; and
 - wherein the two or more parameters comprises two or more of: a parameter indicative of a sensed value of a pressure associated the process or assay, a parameter indicative of a sensed value of a spectrum of at least one biological molecule within the detection zone, a parameter indicative of a sensed value of a temperature associated the process or assay, and a parameter indicative of a current associated with a medium carrying the at least one biological molecule.
2. The method of claim 1, wherein the action is performed if a measured value of at least one of the two or more parameters is within a predetermined amount of an off-scale value.
3. The method of claim 1, wherein the two or more parameters comprises one or more of:
 - a polymer temperature;
 - a capillary temperature;
 - an airflow temperature at a capillary outlet;
 - an airflow temperature at a capillary inlet;
 - a heat sink temperature;
 - a capillary heater temperature;

a buffer temperature;
a snout temperature;
an instrument temperature; and
a laser heat sink temperature.

4. The method of claim 1, wherein the two or more parameters comprises one or more of:

a polymer valve position;
a polymer valve pressure;
a buffer valve position;
a buffer valve pressure;
a syringe position; and
a syringe pressure.

5. The method of claim 1, wherein at least one parameter of the two or more parameters comprises an optical signal produced during detecting the one or more biological molecules within the detection zone.

6. The method of claim 1, wherein the data structure is a dye matrix.

7. The method of claim 1, wherein the sample comprises biological molecules of different length, the method further comprising:

loading the sample into at least one capillary comprising a first end, a second end, and a portion located within the detection zone; and

providing a first electrode electrically coupled to the first end and a second electrode electrically coupled to a second end;

wherein performing a process comprises separating the biological molecules in the sample by producing an electrical potential between the first electrode and the second electrode.

8. A method comprising:

providing a sample solution containing one or more biological sample molecules;
performing a process or assay on the sample solution;

while performing the process or assay, detecting the one or more biological molecules;
before or during detecting, measuring a first system parameter;
before or during detecting, measuring a second system parameter;
performing an analysis on at least some measurements of at least one of the first system parameter and the second system parameter; and
before or during detecting, performing an action based on the analysis,
wherein performing the action is based on the first system parameter or the second system parameter having a value that is outside a predetermined range a plurality of different times during the process.

9. The method of claim 8, wherein the sample solution comprises one or more biological molecules of different length, the method further comprising:

loading the sample solution into at least one capillary, the at least one capillary comprising a detection zone;

performing a process comprising separating the biological molecules within the at least one capillary by producing an electric potential between a first electrode and a second electrode;

measuring a first optical signal produced by illuminating at least one biological molecule in the detection zone;

measuring a second optical signal produced by illuminating the detection zone when the at least one biological molecule is not in the detection zone;

using at least the first optical signal and the second optical signal to determine a signal-to-noise ratio corresponding to the first optical signal; and

during detecting, changing a value of a process parameter based on the signal-to-noise ratio.

10. The method of claim 8, wherein the sample solution comprises one or more biological molecules of different length, the method further comprising:

loading the sample solution into at least one capillary, the at least one capillary comprising a detection zone;

performing a process comprising separating the biological molecules within the at least one capillary by producing an electric potential between a first electrode and a second electrode; and

measuring a current through the at least one capillary.

11. The method of claim 10, further comprising:
determining if the current through the at least one capillary over a plurality of measurements matches a predetermined pattern; and
performing an action based on results of determining.
12. The method of claim 10, further comprising:
while detecting, measuring current in the at least one capillary over time to determine a current trace;
performing an analysis on the current trace; and
performing an action based on the analysis.
13. The method of claim 12, wherein the analysis comprises determining a noise metric corresponding to signal noise in the current trace and further wherein performing an action based on the analysis comprises performing an action based on a value of the noise metric.
14. The method of claim 8, wherein the first system parameter includes pressure and the second system parameter includes temperature.
15. The method of claim 14, wherein a temperature parameter comprises one or more of:
a polymer temperature;
a capillary temperature;
an airflow temperature at a capillary outlet;
an airflow temperature at a capillary inlet;
a heat sink temperature;
a capillary heater temperature;
a buffer temperature;
a snout temperature;
an instrument temperature; and
a laser heat sink temperature.
16. The method according to any one of claims 1-15, wherein the action comprises at least one of:

setting or sending a warning or condition flag;
sending a warning signal;
sending a re-servicing signal;
providing a run quality metric;
changing a dye matrix component;
changing an injection parameter;
setting a process call parameter;
setting or modifying a post run analysis or correction metric;
stopping the process;
pausing the process for a predetermined period of time;
pausing the process until a condition of the process has changed by a predetermined amount;
flushing one or more capillaries;
notifying a user as to a quality of the process;
recording one or more values of the at least two parameters, the values being suitable for correcting or modifying spectrographic data recorded during detecting;
sending a check cartridge signal; and
changing a run condition or a run metric.

17. The method of claim 16, wherein changing the run condition or the run metric comprises one or more of adjusting a timer, adjusting a current, adjusting a voltage, or changing a value in a dye matrix.

18. The method of claim 16, wherein changing the run condition or the run metric comprises adjusting one or more of: a timer, a current, a voltage, a temperature of a system component, or a temperature of the sample.

19. The method according to any one of claims 1-15, wherein the method is performed using an instrument containing historical data of previous processes performed by the instrument and the action comprises modifying the database based on the measured one or more values.

20. A system for use in analyzing dye-labeled samples, the system comprising:
- a sample processing instrument;
 - a processor; and
 - a memory encoded with instructions for carrying out the analysis steps referenced in any of claims 1-19.
21. A system for use in analyzing dye-labeled samples, the system comprising:
- a sample separation instrument;
 - a processor; and
 - a memory encoded with instructions for carrying out the analysis steps referenced in any of claims 1-19.
22. A system for use in analyzing dye-labeled samples, the system comprising:
- a capillary electrophoresis instrument comprising a plurality of capillaries;
 - a processor; and
 - a memory encoded with instructions for carrying out the analysis steps referenced in any of claims 1-19.