

When the camera is saturated, with a conventional data analysis workflow, the dye signals that are measured are inaccurate. The main peak is distorted, and false peaks called “pull-up” are artificially created. One way the operator can control their signal levels is by quantitating their input biological sample such as, e.g., input DNA. The operator can measure the concentration of input DNA, then dilute said concentration if it is too high, both of which take extra time and add cost.

[0005] While a user can manually interpret data that is off-scale, this takes extra time. In their data analysis workflow, peaks that have saturated the camera are called “off-scale”, and are flagged. Their data analysis workflow requires the user to visually inspect all flagged peaks.

[0006] There is therefore a need for an automated recovery of off-scale data that can bypass the additional steps of visual inspection of off-scale peaks and quantitating of input DNA.

SUMMARY

[0007] An aspect of the present disclosure provides a method for recovering off scale data in an image produced by a camera in a capillary electrophoresis instrument. The method comprises the steps of identifying bins of the image where the electron counts produce a signal greater than a maximum camera signal; setting an off-scale flag for the identified bins; and processing the image to obtain a recovered dye signal, based on the flag set for each bin, and using a dye matrix. The method further comprises setting to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off-scale; calculating a modified pseudoinverse dye matrix; and calculating the recovered dye signal using the modified pseudoinverse dye matrix

[0008] In an embodiment, the method further comprises changing a binning pattern of the camera, wherein the change comprises reducing the size of a bin corresponding to a peak for a given dye.

~~[0009] In yet another embodiment, the method further comprises setting to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off scale; calculating a modified pseudoinverse dye matrix; and calculating the recovered dye signal using the modified pseudoinverse dye matrix.~~

[0009a] Another aspect of the present disclosure provides a non-transitory computer-readable storage medium. The computer-readable storage medium includes instructions that when executed by a computer, cause the computer to identify bins of an image where electron counts produce a signal greater than a maximum camera signal; set an off-scale flag for the identified bins; and process the image to obtain a recovered dye signal, based on the flag set for each bin, and using a dye matrix. The computer-readable storage medium further includes instructions that when executed by the computer, cause the computer to set to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off-scale; calculate a modified pseudoinverse dye matrix; and calculate the recovered dye signal using the modified pseudoinverse dye matrix.

[0009ba] Another aspect of the present disclosure provides a biological analysis device for performing capillary electrophoresis. The device comprises a camera configured to detect emission from a sample and produce an image; a processor; and a memory storing instructions that, when executed by the processor, configure the device to identify bins of the image where electron counts produce a signal greater than a maximum camera signal; set an off-scale flag for the identified bins; and process the image to obtain a recovered dye signal, based on the flag set for each bin, and using a dye matrix. The instructions stored in the memory further configure the device to set to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off-scale; calculate a modified pseudoinverse dye matrix; and calculate the recovered dye signal using the modified pseudoinverse dye matrix.

CLAIMS

1. A method for recovering off scale data in an image produced by a camera in a capillary electrophoresis instrument, the method comprising:

identifying bins of the image where electron counts produce a signal greater than a maximum camera signal;

setting an off-scale flag for the identified bins; and

processing the image to obtain a recovered dye signal, based on the flag set for each bin, and using a dye matrix, wherein processing the image further comprises:

setting to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off-scale;

calculating a modified pseudoinverse dye matrix; and

calculating the recovered dye signal using the modified pseudoinverse dye matrix.

2. The method of claim 1, further comprising:

changing a binning pattern of the camera, wherein the changing comprises reducing a size of one or more camera bins corresponding to a peak for a given dye.

~~3. The method of claim 1, wherein processing the image further comprises:~~

~~setting to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off-scale;~~

~~calculating a modified pseudoinverse dye matrix; and~~

~~calculating the recovered dye signal using the modified pseudoinverse dye matrix.~~

43. A non-transitory computer-readable storage medium, the computer-readable storage medium including instructions that when executed by a computer, cause the computer to:

identify bins of an image where electron counts produce a signal greater than a maximum camera signal;

set an off-scale flag for the identified bins; and

process the image to obtain a recovered dye signal, based on the flag set for each bin, and using a dye matrix.

wherein the computer-readable storage medium further includes instructions that when executed by the computer, cause the computer to:

set to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off-scale;

calculate a modified pseudoinverse dye matrix; and

calculate the recovered dye signal using the modified pseudoinverse dye matrix.

54. The non-transitory computer-readable storage medium of claim 43, wherein the computer-readable storage medium further includes instructions that when executed by the computer, cause the computer to change a binning pattern of the camera, wherein the change comprises reducing a size of one or more camera bins corresponding to a peak for a given dye.

~~6. The non-transitory computer-readable storage medium of claim 4, wherein the computer-readable storage medium further includes instructions that when executed by the computer, cause the computer to:~~

~~set to zero any coefficient of the dye matrix corresponding to bins that have been flagged as off-scale;~~

~~calculate a modified pseudoinverse dye matrix; and~~

~~calculate the recovered dye signal using the modified pseudoinverse dye matrix.~~

75. A biological analysis device for performing capillary electrophoresis, comprising:
a camera configured to detect emission from a sample and produce an image;
a processor; and
a memory storing instructions that, when executed by the processor, configure the device to:

identify bins of the image where electron counts produce a signal greater than a maximum camera signal;

set an off-scale flag for the identified bins; and

process the image to obtain a recovered dye signal, based on the flag set for each bin, and using a dye matrix.

wherein the instructions stored in the memory further configure the device to:
set to zero any coefficient of the dye matrix corresponding to bins that have
been flagged as off-scale;
calculate a modified pseudoinverse dye matrix; and
calculate the recovered dye signal using the modified pseudoinverse dye
matrix.

86. The biological analysis device of claim 75, wherein the instructions stored in the memory further configure the device to change a binning pattern of the camera, wherein the change comprises reducing a size of one or more camera bins corresponding to a peak for a given dye.

~~9. — The biological analysis device of claim 7, wherein the instructions stored in the memory further configure the device to:~~
~~set to zero any coefficient of the dye matrix corresponding to bins that have been flagged~~
~~as off-scale;~~
~~calculate a modified pseudoinverse dye matrix; and~~
~~calculate the recovered dye signal using the modified pseudoinverse dye matrix.~~