



OSIRIS – Open Source Software STR Analysis Tool Expanded Process Control Capability



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Abstract

OSIRIS, the Open Source Independent Review and Interpretation System, is a free, open-source software tool for Short Tandem Repeat (STR) analysis, downloadable from the National Center for Biotechnology Information (NCBI) OSIRIS homepage and GitHub. As part of its routine sample analyses, OSIRIS computes unique quality metrics that can be used for sample and process quality control. Mathematical analyses of STR characteristics and artifact signatures show indications of:

- color separation mismatch
- sample degradation
- over or under loading
- impending capillary failure
- peak shifting
- other process failure conditions.

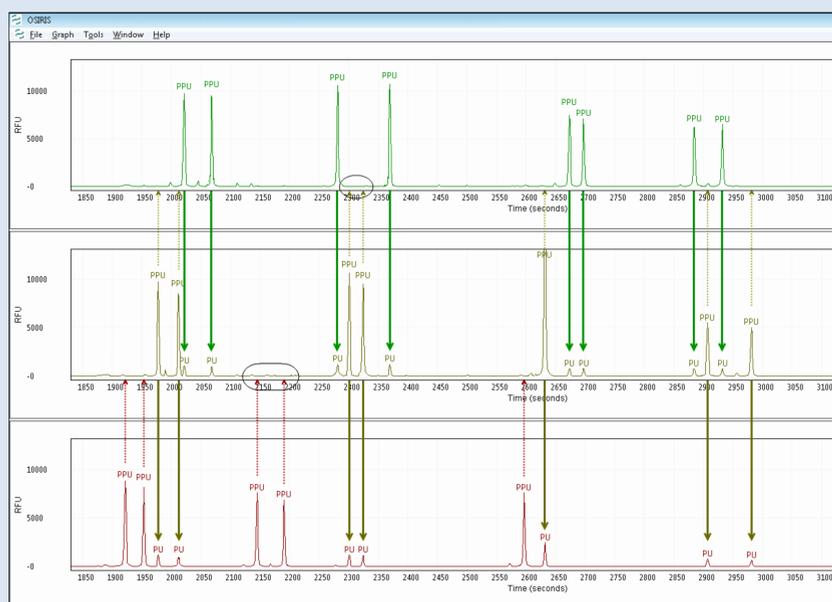
In addition, OSIRIS can: automate real-time checking of control samples in a high throughput lab.

QC Metrics Output

Sampling of OSIRIS output metrics:

- Largest linear pull-up coefficient (A)
- Largest non-linear coefficient (B)
- Max base pair error, sample-to-ladder (C)
- Last ILS peak width (D)
- Peak heights (D)
- Max-to-min area ratio for sample loci (D)
- Max-to-min area ratio for each channel (Degradation or Inhibition)
- Measured noise for each channel
- Ambient measurements for temperature, voltage, current and power

Pull-up Pattern Indicates Quality Issues



Similar-sized peaks cause similar-sized pull-up in other channels. In this sample the pattern is shown with solid arrow indicating pull-up and dashed arrows and circles indicating lack of pull-up.

PU – pull-up, solid arrows; PPU – peak causing pull-up; Other artifacts not labeled. Identifier, analyzed data.

Color Separation Mismatch and Over-Loading

OSIRIS checks (using least median of squares) for a pull-up pattern, determines which are outlier peaks – alleles – in the pattern, removes alleles from pattern analysis, and uses regression with both linear and non-linear contribution to quantify true pull-up pattern.

- (A) Linear regression coefficient indicates spectral matrix color separation mismatch.
- (B) Non-linear regression coefficient indicates over-loading.

Max Base Pair Error (C)

Max base pair errors, exported from OSIRIS output. Unusually large values indicate possible shifting.

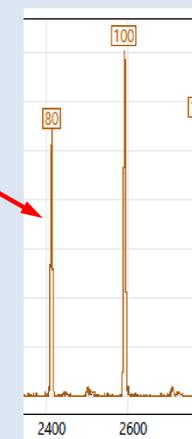
Sample1	4.23E-03
Sample2	8.88E-03
Sample3	0.274952
Sample4	7.10E-03
Sample5	5.11E-03
Sample6	0.352054
Sample7	8.10E-03
Sample8	5.73E-03

Large Compared to Others

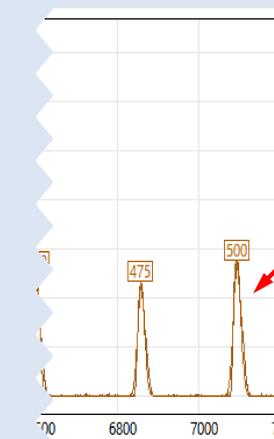
Possible Capillary or Injection Failure (D)

Large discrepancy in width / height from first to last ILS peak

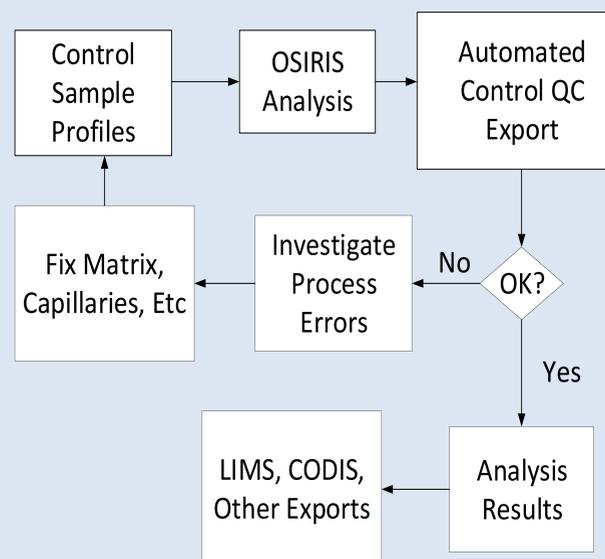
1st ILS Peak:
Width 4.6
Height 10,846 rfu



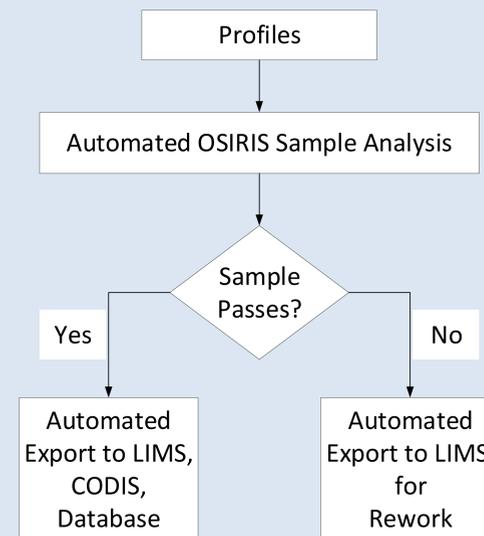
Last ILS Peak:
Width 21.1
Height 5,508 rfu



Automated High Volume Control QC Using OSIRIS Exports



Automate Sample Analysis and Retesting Using OSIRIS Exports



OSIRIS Software

- Open source
- Validated as an expert system
- Cross-platform
 - PC (XP/Win7/8/10)
 - Mac OSX
- Displays
 - Stacked graph
 - Table
- Quality analysis
- Reanalysis prediction
- Flexible User configuration
- Flexible export
 - Table, LIMS, graphical
- Configured for most kits
- Files in both .hid and .fsa format
- Rapid analysis
 - < 30 s/96 samples

Using OSIRIS

OSIRIS is a freely available download on the Osiris web page : <http://www.ncbi.nlm.nih.gov/projects/SNP/osiris/>

The Osiris User's Guide is on the homepage and in the program (F1) with a tutorial. The download includes demonstration data from various kits.

Open Source Collaboration

OSIRIS source code is on the GitHub repository. We invite new collaborators to join the Osiris community to help improve Osiris.

For questions or requests, please contact: forensics@ncbi.nlm.nih.gov

For announcements about Osiris releases and tips, subscribe to the Osiris announcement list: <http://www.ncbi.nlm.nih.gov/mailman/listinfo/forensics-announce>



Email a question.



Osiris Home page.

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