How Moving Averages Can Help Enhance Quality Control and Improve your Laboratory

July 22, 2015
Moving Averages in the Lab – Why?

• Enhances Organization’s Quality Assurance program in a cost effective manner

• Provides a ‘real time’ quality tool to reassure staff that they are producing quality results in lean staffing environment (less stress)

• Decreases re-work

• Positively Enhances the Lab’s Reputation with Physicians and Nursing Staff
Moving Averages in the Lab – What does it do?

• “Normalizes” result data so that the lab can gauge the likelihood that a trend will continue

• Proactively monitors instrument stability between QC cycles in the background

• Uses Error and Warning Thresholds to automatically push notifications to key laboratory staff, and in conjunction with auto-verification allows for a true “walk away” process

• Enables preemptive intervention before the process fails by detecting shifts, trends & momentum
Value of Moving Average / Moving Medians

• Value...
  
  *Instantly and automatically detect and notify when analytical errors occur without increasing operational costs.*

• How?
  
  ✓ ...By continuously monitoring results production
  ✓ ...That detects analytical errors days before traditional QC,
  ✓ ...Using revenue generating samples
Moving Averages Compliments QC

**Standard QC**
- QC is a “snapshot” in time
- Usually performed post maintenance & calibration
- Potential for hours (or days) before some errors are detected

  ✓ Once a shift – 60-70% of test volume between 6 am to 11 am or

  ✓ Once per day (100% of test volume before next data point

- Matrix Effects

**Moving Averages**
- Real-Time, proactive process providing continuous monitoring using Patient Samples
- Early detection of shifts and drifts hours / days before traditional QC
  - Continuous data points to detect shifts/drifts
- Automatically “pushes” instrument status stability notifications
- Provides data points, while producing revenue generating activities
  - No Instrument out of production
  - No Dedicated resource (walk away) with notification capabilities
  - No non-reimbursed reagent material or control material
- QC can be run at recommended regulatory intervals (Cost savings in $ and time)
Real-time Moving Averages / Moving Medians

Providing an enterprise-wide quality assurance

• Monitor any test, any connected instruments
  ✔ from anywhere on your network
  ✔ Levy-Jennings Charts to compare multiple instruments
  ✔ Monitor same tests different ways – Unlimited Protocols

• Monitors in Real-time
  ✔ Provides detection and notification actions

• Has twelve algorithms including:
  ✔ Moving Averages, Moving Medians, Exponentially-Weighted Moving Averages.

• User-defined filter criteria to segment data
• Ability to generate values for your patient population
# Moving Averages / Moving Medians

## Twelve different statistical algorithms available

<table>
<thead>
<tr>
<th>Base Package</th>
<th>Add-on Algorithms 1</th>
<th>Add-on Algorithms 2</th>
<th>Add-on Algorithms 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Moving Means</td>
<td>• Moving Medians</td>
<td>• Moving Mean *1 Log</td>
<td>• Moving Median *1 Log</td>
</tr>
<tr>
<td>• Bull’s Algorithm</td>
<td></td>
<td>• Moving Mean *1000 Log</td>
<td>• Moving Median *1000 Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Moving Mean *1 Square Root</td>
<td>• Moving Median *1 Square Root</td>
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<td>• Moving Mean *1000 Square Root</td>
<td>• Moving Median *1000 Square Root</td>
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</tbody>
</table>

• Additional custom algorithms may be developed & added
Getting Started (Outline)

• Establish your average of “normal” population (AON)
  ✓ Create a Protocol
    ▪ Name / Description
    ▪ Filters - Segment to exclude QC, Abnormal patients, fluid type
    ▪ Automatic results exclusion - Exclude clearly bad results ( +/- 4 SD)
    ▪ Calculation Method
    ▪ Automatically calculate Target Mean and Target SD – Calculate your values using your patient population
  ▪ Series - (New Series)
    » What instrument(s) and analyte(s) to monitor
  ✓ Copy Protocol - Lather, Rinse, Repeat

• Monitor
  ✓ Moving Averages Desktop - Thin Client or Web Browser
Defining “Normal” Population

• Some hospital labs may elect to exclude patients at certain wards:
  ✓ Pediatric
  ✓ Hematology/oncology
  ✓ Dialysis
  ✓ ICU and ED (trauma) patients

• Other criteria:
  ✓ Diagnosis Code / Text
  ✓ Patient Demographics (Age, Sex, Ethnicity, etc.)
  ✓ Inpatient vs. Outpatient
  ✓ Assays where population is not “normal”
  ✓ Result values outside a defined range (ex. 4SD + - mean)
Protocol Definition – Defining “Normal” Population
Moving Averages Desktop

List of user-defined protocols

- Glucose MA Protocol selected for view
- Series of data for the same test on a different instrument
- Series of data for one test on one instrument
- Information about the Protocol being reviewed
- A selected data point
- Data for the point selected on the line
- Data for the results that make up the moving average point
Moving Averages Desktop

Monitor assay / individual instrument performance
Moving Averages Desktop

Compare Multiple Instruments for an assay
Moving Averages Desktop

Multiple instrument series comparison for an assay
Moving Averages Desktop

Standard MA vs. Exponential MA
Moving Averages Desktop Example

Screenshot from customer monitoring results in real-time
Getting Started (Outline) - continued

That was fun … what can I do now?

• Setup Notification
  ✓ Email
  ✓ Pop up screen on selected computers
  ✓ Light Pole

• Fine tune existing protocols
  ✓ Filters - Segment to exclude other ‘abnormal’ patients

• Act on warnings – looking for shifts and drifts

• Establish multiple protocols for different patient populations (i.e. Outreach vs Inpatients)
## Protocol Definition – System Notifications

### Protocol Configuration

#### General Protocol Options

#### Protocol Details

<table>
<thead>
<tr>
<th>Series</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose:</td>
<td>Chem1</td>
</tr>
<tr>
<td>Glucose:</td>
<td>Chem 2</td>
</tr>
</tbody>
</table>

#### Warnings and Errors

<table>
<thead>
<tr>
<th>Event</th>
<th>Threshold Value</th>
<th>Notifier Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Low</td>
<td>2 (Standard Deviations Below mean)</td>
<td>MA - Warning Low</td>
</tr>
<tr>
<td>Warning High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error High</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Changing items marked with ** will require a restart. Changing items marked with * will suggest a restart.
Methods of Monitoring / Notifications

- Status Screen
- Moving Averages Desktop
  - Thin Client
  - Web Browser
- Notifier
  - Email
  - Pop up screen on selected computers
  - Light Pole
Moving Average Threshold Violation Notifications

At 8/17/2011 12:34:30 PM this message was generated:

Error-Low Threshold Exceeded, check Inpt and Outpt graphs
Result for Specimen ID: 112280225B
created a point below the error threshold for Moving Averages protocol: TP-N on series: All.
Error low threshold triggered.

Message from TRAINING008061 to TRAINING008061 on 4/6/2010 11:11:32 AM
Moving Average exceeded warning threshold
At 4/6/2010 11:11:29 AM this message was generated:
Moving Average exceeded warning threshold
Result for Specimen ID: 654 created a point above the warning threshold for Moving Averages protocol: Glucose on Man1 on series: MREI 1. Warning high threshold triggered.

OK
Earlier Detection

Lab Manager was notified by IM before lab or QC notice issue

From: IM Moving Averages Server [m.moving.averages@Hitch
To: Frank A
Cc: 
Subject: Error-High Threshold Exceeded, check Inpt and Outpt graphs

At 11/16/2011 12:20:23 PM this message was generated:

Error-High Threshold Exceeded, check Inpt and Outpt graphs Result for Specimen ID: 113201230C created a point above the error threshold for Moving Averages protocol: Na-All Pts exclusion set at 3.0 sd on series: C2. Error high threshold triggered.

From: Timothy
Sent: Wed November 16, 2011 12:49 PM
To: Frank A. Polito;
Subject: C502 Na Issue

C502 ISE’s were shut off just after rounds today because we began to see the ISE issue again. Diane had seen a couple repeat Na’s by that time that she couldn’t feel good about.

We actually turned the ISE’s on on C501 (doesn’t use the affected R2 probe system), and have contacted Dave and did conform what we had done was “okay”.

He will be here by 1500,
Getting Started (Outline) - continued

There can’t possibly be anything else this thing can do?

- Optional: Integrate in Autoverification
- Optional: MA/MM Bracketing

- Buffers result release
- Enhancement to QC program for autoverification
- QC Bracketing (in conjunction with the MA Bracketing functionality)
Protocol Definition – System Actions

**General Protocol Options**

**Protocol Details**

- **Series**
  - Glucose: Chem1
  - Glucose: Chem2

**Warnings and Errors**

- Error Low
- Warning Low
- Warning High
- Error High

<table>
<thead>
<tr>
<th>Threshold Value</th>
<th>3 (Standard Deviations Above mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notifier Event</td>
<td>MA - Error High</td>
</tr>
<tr>
<td><strong>Start Holding for Verification</strong></td>
<td>Hold this test</td>
</tr>
<tr>
<td>Mark out of service</td>
<td>Do not hold tests</td>
</tr>
</tbody>
</table>

Changing items marked with ** will require a restart.
Moving Averages Desktop

Removing data points from MA Calculations
What Makes Instrument Manager’s Moving Averages Unique?
Key Differentiators

• Filtering Mechanism: Ability Optimize Normal Population
• User Driven Real-Time Alerting
• User Driven Real-Time Actions
• Enterprise-Wide Solution Not Limited to a Work Area
• Manual Exclusion of Result Values with automatic Audit Trail creation
• Instrument independent for comparison (doesn’t have to be same instrument)
Need Help Getting Started?

DI offers

• ‘Getting started’ sessions to educate on how to get started (no charge)

• Instructional courses on how to setup, configure and get the most from MA

• Customized configuration, installation and training – we will do the initial set up for you
Questions?

Thank you for your time!
For more information please contact:

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