100 Barr Harbor Drive ■ PO Box C700 ■ West Conshohocken, PA 19428-2959
Telephone: 610-832-9500 ■ Fax: 610-832-9555 ■ e-mail: service@astm.org ■ Website: www.astm.org

Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

Chairman: W. JAMES BOVER, ExxonMobil Biomedical Sciences Inc, 1545 Route 22 East, PO Box 971, Annandale, NJ 08801-0971, (908) 730-1048, FAX: 908-730-1197, EMail: wjbover@erenj.com
First Vice Chairman: KENNETH O. HENDERSON, Cannon Instrument Co, PO Box 16, State College, PA 16804, (814) 353-8000, Ext: 0265, FAX: 814-353-8007, EMail: kenohenderson@worldnet.att.net
Second Vice Chairman: SALVATORE J. RAND, 221 Flamingo Drive, Fort Myers, FL 33908, (941) 481-4729, FAX: 941-481-4729
Secretary: MICHAEL A. COLLIER, Petroleum Analyzer Co LP, PO Box 206, Wilmington, IL 60481, (815) 458-0216, FAX: 815-458-0217, EMail: macvarlen@aol.com
Assistant Secretary: JANET L. LANE, ExxonMobil Research and Engineering, 600 Billingsport Rd, PO Box 480, Paulsboro, NJ 08066-0480, (856) 224-3302, FAX: 856-224-3616, EMail: janet_l_lane@email.mobil.com
Staff Manager: DAVID R. BRADLEY, (610) 832-9681, EMail: dbradley@astm.org

Originally Issued: May 19, 2010

Reply to: Richard Grundza
ASTM Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206
Phone: 412-365-1031
Fax: 412-365-1047
Email: reg@astmtmc.cmu.edu

Unapproved Minutes of the May 13, 2010
Sequence V Surveillance Panel Meeting
held in San Antonio, TX

A copy of the Agenda is included as Attachment 1

The signed attendance sheet is included as Attachment 2.

Minutes from November 19, 2009 Surveillance panel meeting were approved with no changes.

Action Item Review

Motions and Action Items

As Recorded at the Meeting by Bill Buscher

1. Action Item O&H task force to perform a thorough Sequence VG test procedure review, and to investigate poor precision that was observed during the fuel prove-out matrix.
Incomplete, discussions have taken place, but no task force has been formed

2. Action Item Haltermann to distribute monthly status reports for the current fuel batch to the SP members.
Not completed, to be discussed this meeting
3. Action Item SP to request a fuel batch approval plan from the TGC test fuel task force.
To be discussed this meeting

4. Action Item Schedule a SP conference call in March 2010 to review status of current fuel batch, review the approval process for a new fuel batch and plan for blending a new batch.
Conference call was held, complete

5. Action Item FCS to contact labs with details on shipping and handling costs for the replacement pistons.
Pistons being shipped, Complete

6. Action Item Labs to submit purchase orders to FCS for the replacements pistons within one week of receiving the information mentioned in the action item above.
Completed with item above

7. Action Item To see if we have a potential GF-4 or GF-5 reference oil for the VG, TMC to query suppliers of 5 primary VID reference oils (A, B, C, D and X) to see if data exists for these oils on the other GF-5 engine tests, or if they would be willing to generate data on the other GF-5 engine tests.
Two oils being brought forward, to be discussed this meeting, complete

8. Action Item Plan for an LTMS review at the May 2010 Surveillance Panel meeting, or preferably sooner, once the LTMS task force and TGC has met.
Open forum Meeting held 5/11/10, to be discussed this meeting.

Test Sponsor Report
Ron Romano gave a verbal report. The major issue being dealt with was the replacement pistons, which are due to be received here late this week. The remainder of the pistons will be shipped later , as there have been some issues with scrappage. There are currently no plans for continuing the VG beyond 2015.

TMC Report
There was no report given. A copy of the TMC report can be accessed via the following link.
ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencev/semiannualreports/vg-04-2010.pdf

ACC Report.
A copy of the report is available via the following link. There were no questions on the report.
https://acc-ma.org/docs/pcmo/iva/SemiAnnualReports/2010APR_IVA.pdf

Fuel Suppliers Report.
Mark Overaker gave a report on the status of the current blend of SVGMII fuel. Haltermann currently has 114000 gallons on hand and usage is following their projections. After considerable discussions, the panel agreed that a pilot blend, with subsequent tests, would not be necessary. Haltermann agreed to gather components and make a large blend, whose speciation would be made available to the lab, along with the speciation of the previous batch, for verification purposes. A teleconference would be conducted to review the speciation data. A Lopez suggested Haltermann may wish to learn what adjustments could be made to the fuel to return off target performance to acceptable levels. Mark Overaker responded favorably to these remarks. Testing protocol for the new blend was discussed, and the panel decided to have the Statistics Group and the TMC representative(s) develop a matrix for testing the batch. Dan Worcester suggested that the previous matrices may have been too heavily skewed to reference oil 925-3. The

Statistics group agreed to look at he appropriateness of the reference oils. A copy of the fuel suppliers report is included as attachment 3.

LTMS Version 2

Doyle Boese presented the LTMS Task Forces recommendations for changes to the Sequence V LTMS. There were many concerns expressed about reducing the number of critical parameters to two. The panel decided to form a small group to review he LTMS changes and make recommendations to the panel, the group will report back to the panel by July 13, 2010. A copy of the presentation is included as attachment 4.

New Business

The panel was presented with a potential motion to address aborted/invalid non reference oil tests as they relate to the test counter for runs between references Al Lopez had encountered a test which had to be aborted at the start and lost a potential non reference oil test. However, after considerable discussion, no agreement on rewording Section 11.1.1 of the test method could not be reached. The Test Labs and TMC will conduct a conference call to resolve this and submit to the panel for potential ballot when complete. Additional hardware items were discussed. Southwest Research indicated they may run out of blocks by 2013. Southwest also indicated that cylinder heads may be lasting longer than they originally planned. Several labs expressed some discomfort with the quality of the reworked heads that are being received from AER. Also, Southwest had tried to use a block obtained from Bishop, but he cylinders would not clean up and many of the blocks need modifications to accept the timing chain cover used by this group.

Scope and Objectives

Andy Ritchie's report to Subcommittee B, as well as scope and objectives were reviewed and updated and are included as attachment 5.

GF-5 Category Oils

The panel reviewed testing data for to potential candidate oils. The panel agreed that either oil would be suitable for Sequence V testing. Copies of results summaries are included as attachments 6 and 7
`

A listing of the action items from this meeting are included as attachment 8.

The meeting was adjourned at 11:40 pm.

Attachment 1

Sequence VG Surveillance Panel
San Antonio, TX
Southwest Research Institute
May 13, 2010
9:00 a.m. - 12:00 p.m.

A G E N D A

1. Chairman comments.

2. Attendance sign-in distribution.

3. Membership changes.

4. Motion and Action recorders.

5. Approval of minutes for November 19th 2009. All

6. Review action items from last meeting. Andy Ritchie

7. Test Sponsor report. Ron Romano

8. TMC Report. Questions on semi-annual report. Rich Grundza

9. ACC Report. Questions on semi-annual report. Jeff Clark

10. Fuel Supply Report. James Carter

11. Plans for new fuel batch. All

12. LTMS V2 review. Doyle Boese for Phil Scinto

13. Review Scope and Objectives. All

14. Old business All

15. New business All

16. Adjourn

Attachment 2

ASTM Sequence V Surveillance Panel — May 13, 2010

Name/Address	Phone/Fax/Email		Signature
Ed Altman Afton Chemical Corporation P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5279 804-788-6358 ed.altman@aftonchemical.com	Voting Member	Present
Ron Buck Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-877-0223 210-690-1959 rbuck@tei-net.com	Non-Voting Member	Present
Doyle Boese Infineum 1900 E. Linden Avenue Linden, NJ 07036 USA	908-474-3176 908-474-3637 doyle.boese@infineum.com	Non-Voting Member	Present
Adam Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 adbowden@ohtech.com	Non-Voting Member	Present
Jason Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 jhbowden@ohtech.com	Voting Member	Present
Dwight H. Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 dhbowden@ohtech.com	Non-Voting Member	Present
Bill Buscher III Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-6802 210-684-7523 william.buscher@swri.org	Non-Voting Member	Present

Name/Address	Phone/Fax/Email		Signature
Jerry Brys The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2631 440-347-4096 jerome.brys@lubrizol.com	Non-Voting Member	Present
James Carter Haltermann Products 3520 Okemos Rd. Suite #6-176 Okemos, MI USA	517-347-3021 517-347-1024 jecarter@jhaltermann.com	Voting Member	Present
Bob.Campbell Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5430 804-788-6358 bob.campbell@aftonchemical.com	Non-Voting Member	Present
Chris Castanien The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2973 440-944-8112 cca@lubrizol.com	Non-Voting Member	Present
Timothy L. Caudill Ashland Oil Inc. 22nd & Front Streets Ashland, KY 41101 USA	606-329-1960 x5708 606-329-2044 tlcaudill@ashland.com	Voting Member	Present
Martin Chadwick Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-706-1543 210-684-6074 martin.chadwick@intertek.com	Non-Voting Member	Present
Jeff Clark Sequence III Secretary ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1032 412-365-1047 jac@atc-erc.org	Non-Voting Member	Present
Sid Clark Southwest Research 50481 Peggy Lane Chesterfiled, MI 48047 USA	586-873-1255 Sidney.L.Clark@sbcglobal.net	Non-Voting Member	Present

Name/Address	Phone/Fax/Email		Signature
Todd Dvorak Afton Chemical Corporation P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788- 6367 804-788- 6388 todd.dvorak@aftonchemical.com	Non-Voting Member	Present
Frank Farber ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1030 412-365-1047 fmf@astmtmc.cmu.edu	Non-Voting Member	Present
Gordon R. Farnsworth Infineum RR # 5 Box 211 Montrose, PA 18801 USA	570-934-2776 570-934-0141 gordon.farnsworth@infineum.com	Non-Voting Member	Present
Joe Franklin Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-523-4671 210-523-4607 joe.franklin@intertek.com	Non-Voting Member	Present
David L. Glaenzer Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5214 804-788-6358 dave.glaenzer@aftonchemical.com	Non-Voting Member	Present
Richard Grundza ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1031 412-365-1047 reg@astmtmc.cmu.edu	Voting Member	Present
Charles (Bud) Hyndman RohMax USA, Inc 725 Electronic Drive Horsham, PA 19044-2228 USA	215-706-5825 charles.hyndman@degussa.com	Non-Voting Member	Present
Tracey King Chrysler LLC 800 Chrysler Drive CIMS 482-00-13 Auburn Hills, MI 48326-2757 USA	248-576-7500 248-576-7490 tek1@chrysler.com	Voting Member	Present

Name/Address	Phone/Fax/Email		Signature
Raham Kirkwood Southwest Research Institute 6220 Culebra Road San Antonio TX 78238-5100 USA	rahaml.kirkwood@swri.org	Voting Member	Present
Clayton Knight Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-690-1958 210-690-1959 cknight@tei-net.com	Voting Member	Present
Charlie Leverett Intertek			
Al Lopez Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-647-9465 210-523-4607 al.lopez@intertek.com	Voting Member	Present
Josephine G. Martinez Chevron Oronite Company LLC 100 Chevron Way Richmond, CA 94802 USA	510-242-5563 510-242-3173 jogm@chevrontexaco.com	Non-Voting Member	Present
Bruce Matthews GM Powertrain Mail Code 483-730-472 823 Jocyln Avenue Pontiac, MI 48340 USA	248-830-9197 248-857-4441 bruce.matthews@gm.com	Voting Member	Present
Timothy Miranda Castrol Technology Center 240 Centennial Avenue Piscataway, NJ 08854 USA	732-980-3634 973-686-4039 Timothy.Miranda@Castrol.com	Voting Member	Present
Allison Rajakumar The Lubrizol Corporation Drop 152A 29400 Lakeland Blvd. Wickliffe, OH 44092 USA	440-347-4679 440-347-2014 Allison.Rajakumar@Lubrizol.com	Non-Voting Member	Present
Andrew Ritchie Infineum 1900 East Linden Avenue P.O. Box 735	908-474-2097 908-474-3637 Andrew.Ritchie@Infineum.com **Surveillance Panel Chair**	Voting Member	Present

Name/Address	Phone/Fax/Email		Signature
Linden, NJ 07036 USA			
Ron Romano Ford Motor Company Diagnostic Service Center II Room 410. 1800 Fairlane Drive Allen Park, MI 48101 USA	313-845-4068 313-32-38042 rromano@ford.com **Test Sponsor Representative**	Voting Member	Present
Jim Rutherford Chevron Oronite Company LLC 100 Chevron Way Richmond, CA 94802 USA	510-242-3410 510-242-3173 jaru@chevrontexaco.com	Non-Voting Member	Present
Philip R. Scinto The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2161 440-347-9031 prs@lubrizol.com	Non-Voting Member	Present
Don Smolinski GM R & D Mail Code 480-106-269 30500 Mound Road Warren, MI 48340 USA	248-255-7892 Donald.j.smolinski@gm.com	Voting Member	Present
George Szappanos The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2153 440-347-4096 greg.seman@lubrizol.com	Voting Member	Present
Mr. David Walker P. O. Box 979 AER Manufacturing Inc. 1605 Surveyor Boulevard Carrollton TX 75006	Phone: (972) 417-3182 davidwalker@aermfg.com	Non-Voting Member	Present
MARK OVERAKER HALTERMANN PRODUCTS 15635 JACINTO PORT BLVD HOUSTON, TX 77015 832-376-2202 MHOVERAKER@JHALTERMANN.COM	AL Lopez Intertek al.lopez@intertek.com 210-862-7935		

Name/Address	Phone/Fax/Email		Signature
Matt J. Snider GM Powertrain General Motors Corporation MC - 483-730-322 823 Joclyn Rd. Pontiac, MI 48090-9055 USA	248-672-3563 248-857-4441 mathew.j.snider@gm.com	Non-Voting Member	Present
Thomas Smith Valvoline P.O. Box 14000 Lexington, KY 40512-1400 USA	859-357-2766 859-357-7084 trsmith@ashland.com PCEOCP Chair	Voting Member	Present
Mark Sutherland Chevron Oronite Company LLC 4502 Centerview Drive Suite 210 San Antonio, TX 78228 USA	210-731-5621 210-731-5699 msut@chevrontexaco.com	Voting Member	Present
Ben O. Weber Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-5911 210-684-7530 bweber@swri.edu **Sub-Committee D02.B01 Chair**	Non-Voting Member	Present
Joe Vujica The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2058 440-347-4096 jsvu@lubrizol.com	Non-Voting Member	Present
Jerry Wang Chevron Oronite Company LLC 7080 Colchester Lane Ypsilanti, MI 48197	734-48- 3806 none jwdy@chevron.com	Non-Voting Member	Present
DAN WORCESTER	DWORCESTER@SWRI.ORG	NVM	
Wayne Petersen Haltermann Products 15635 Jacinto port Houston, TX 77015	832-376-2213 wepetersen@jhaltermann.com		

Attachment 3

PRODUCT INFORMATION

Haltermann PRODUCTS

T (281) 457-2768 F (281) 457-1469

PRODUCT: SVGM2 Seq. VG

Batch No.: XC2721NX10 MTS

PRODUCT CODE: HF295

Tank No.: 62

Analysis Date: 3/31/2009

TEST	METHOD	UNITS	SPECIFICATIONS			RESULTS
			MIN	TARGET	MAX	
Distillation - IBP	ASTM D86	°C	23.9		35.0	28.9
5%		°C				44.1
10%		°C	48.9		57.2	51.3
20%		°C				64.6
30%		°C				80.7
40%		°C				98.6
50%		°C	98.9		115.6	108.3
60%		°C				114.4
70%		°C				123.4
80%		°C				145.3
90%		°C	162.8		176.6	175.4
95%		°C				192.8
Distillation - EP		°C	196.1		212.8	208.6
Recovery		vol %		Report		98.0
Residue		vol %			2.0	1.1
Loss		vol %		Report		0.9
Gravity	ASTM D4052	°API		Report		57.6
Specific Gravity	ASTM D4052	kg/m^3		Report		0.7474
Reid Vapor Pressure	ASTM D5191	kPa	60.6		63.4	62.7
Carbon	ASTM E191	wt fraction	0.8580		0.8690	0.8632
Carbon	ASTM D3343	wt fraction		Report		0.8664
Oxygen	ASTM D4815	wt %			0.05	<0.01
Sulfur	ASTM D4294	mg/kg			200	<17.0
Lead	ASTM D3237	mg/l			2.6	<2.5
Phosphorous	ASTM D3231	mg/l			1.3	<0.2
Composition, aromatics	ASTM D1319	vol %			35.0	30.4
Composition, olefins	ASTM D1319	vol %	5.0		10.0	5.9
Composition, saturates	ASTM D1319	vol %		Report		63.8
Oxidation Stability	ASTM D525	minutes	1440			>1440
Copper Corrosion	ASTM D130				1	1a
Existent gum, washed	ASTM D381	mg/100mls			3.0	<0.5
Research Octane Number	ASTM D2699		96.0		98.0	98.0
Motor Octane Number	ASTM D2700			Report		89.2
R+M/2	D2699/2700			Report		93.6
Sensitivity	D2699/2700		7.5			9.2
Net Heat of Combustion	ASTM D240	Btu/lb		Report		18395
Additive, Ethyl antioxidant	calculated	ptb		Report		3.5

Attachment 4

The Second Addition of LTMS

(Theoretical Sneak Peak for the VG)

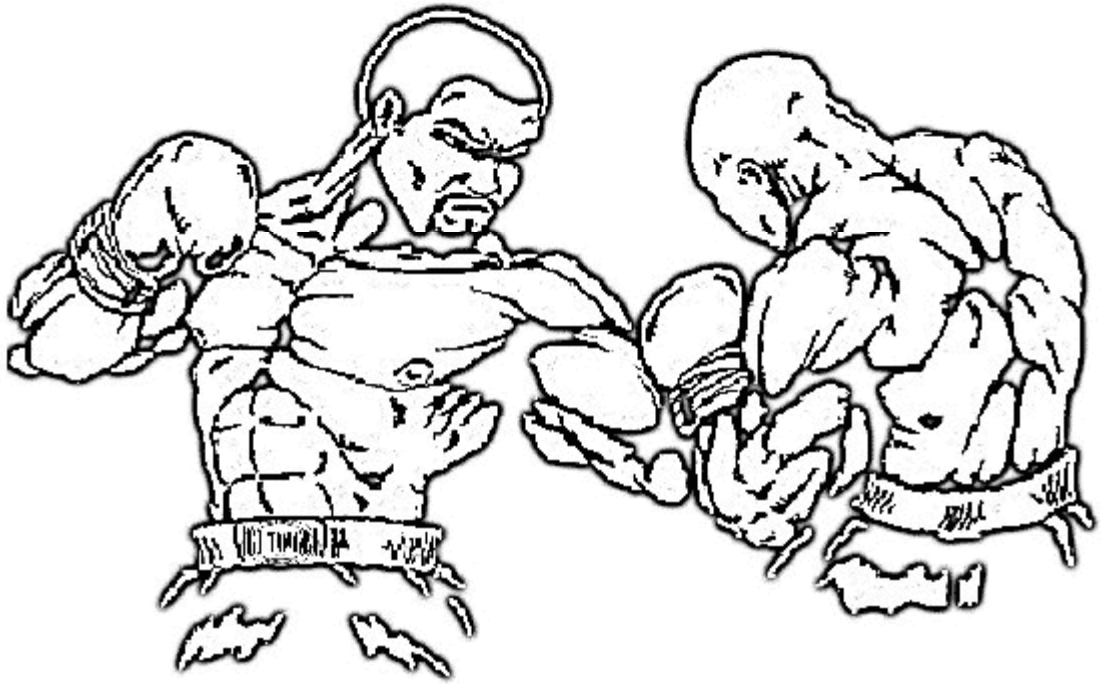
VG SP: May 2010

Basic Idea for LTMS 2nd Edition

- A Simpler, More Robust System
- Improve Candidate Test Accuracy
- Remove Unnecessary Tests and Punishments for Being “Off-Target”
- Remove Opportunities for Games and Poor Choice Changes
- Standardize Across Test Types as Much as Possible

New LTMS Versus Old LTMS

- The Showdown



DO NOT BE AFRAID

- Proposed Changes to LTMS are Slight and are not Expected to Have Major Ramifications

Summary of Proposed Changes

- No more Consequences for Yi
  - Eliminate Punishment for Being Different
- No more Ri or Qi
  - Less Games and Invalid Tests
- Default Limit of 15(18) Non-Reference Tests or 12(18) Months for an Existing Test Stand
- Primary and Secondary Parameters
- Two Suggested Approaches for Introduction of New Hardware, Parts, Fuel, etc.
- Suggestion to Fix Targets, but Update Standard Deviations when Appropriate

Summary of Proposed Changes

- New Control Charts
  - EWMA of Yi (Zi)
    - Continuous Severity Adjustments
      - SP Sets Limits for Zi
  - Shewhart of Residuals: $e_i=(Y_i - Z_{i-1})$
    - Are you Where you Think you Are
    - Apply to Primary Parameters Only
      - Level 3, Level 2, Level 1
      - Can Reduce AND Extend Reference Intervals
      - Undue Influence Analysis

Summary of Proposed Changes

- Suggested Default λ
  - 0.2, but 0.3 a Good One Too
- Fast Start to EWMA
  - Z_0 = Average of First 3 Tests
- Initial Calibration
  - 3 Tests for First Stand in a New Lab
    - Lab Based Severity Adjustment System
  - 3 Tests for each and every Stand/Engine
    - Stand Based Severity Adjustment System

Take a Breathe

- Any Clarification Questions?

Back to the Basics

- Do we Wish to Review the Basics of LTMS and Control Charts?

Take a Breathe

- Do we Understand the Control Charts and their Function?

Take a Breathe

- Any Questions on the Continuous SA?

Flowchart of the New Process

- Can Review if Desired

New LTMS for the VG

- Specific System Suggestions for VG
- Examples are Crude
  - Things Would Likely have Played Out Differently Under the New System
  - Some Calculations Pretend that References are Candidates

New LTMS for the VG

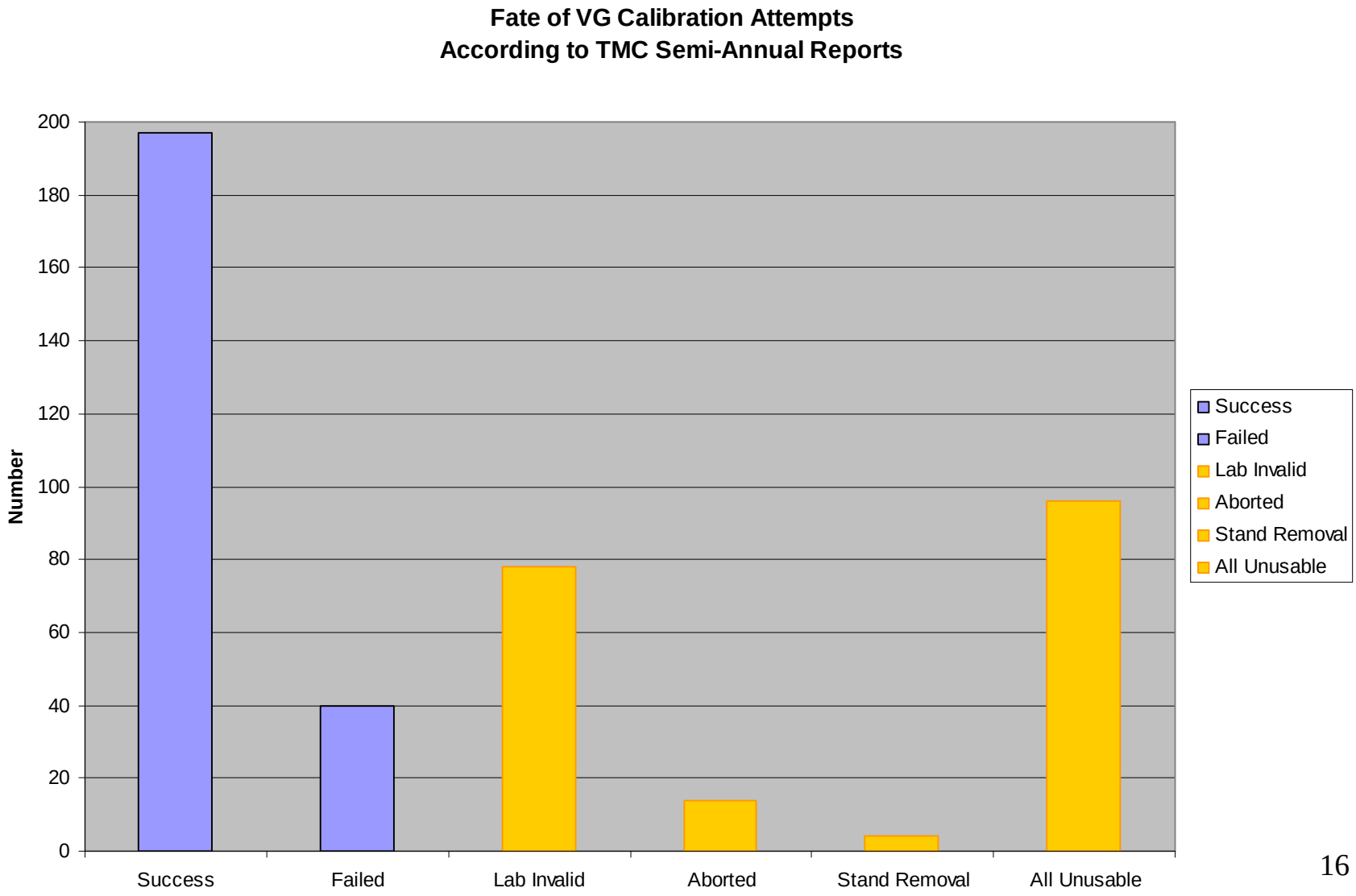
- Lab Based Severity Adjustment System
- Primary Parameters
  - Average Engine Sludge
  - Average Piston Varnish
- Secondary Parameters
  - Rocker Cover Sludge
  - Average Engine Varnish
  - Oil Screen Sludge
- Limit of 15 Non-Reference Tests or X Months for an Existing Test Stand
  - Set X Equal to 6, 9 or 12
- Start System with “Next” Reference Test after Surveillance Panel Approval

New LTMS for the VG

EWMA of Standardized Test Result: Zi			
Parameter	Limit Type	Lambda	Limit
AES	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	2.0
	Level 1	0.2	0.0
APV	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	2.0
	Level 1	0.2	0.0
RCS	Level 2 Lower	0.2	-3.0
	Level 2 Upper	0.2	1.5
	Level 1	0.2	0.0
AEV	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	2.0
	Level 1	0.2	0.0
OSCR	Level 2 Lower	0.2	-2.0
	Level 2 Upper	0.2	1.6
	Level 1	0.2	0.0

Shewhart Chart of Prediction Error	
ei = Yi - Zi-1	
Limit Type	Limit
Level 3	2.066
Level 2	1.734
Level 1	1.351
Undue Influence Follow Up	2.066

New LTMS for the VG



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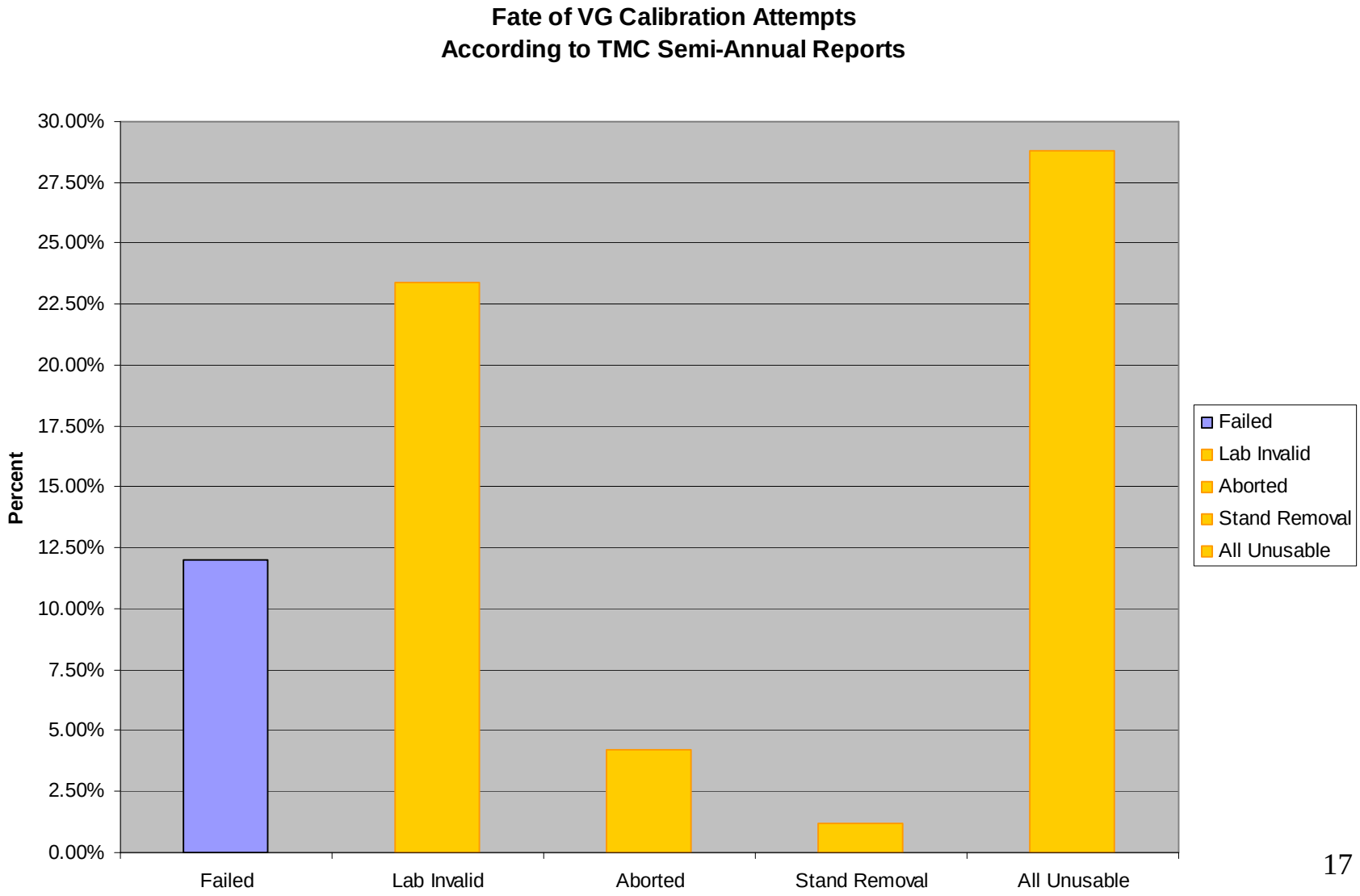

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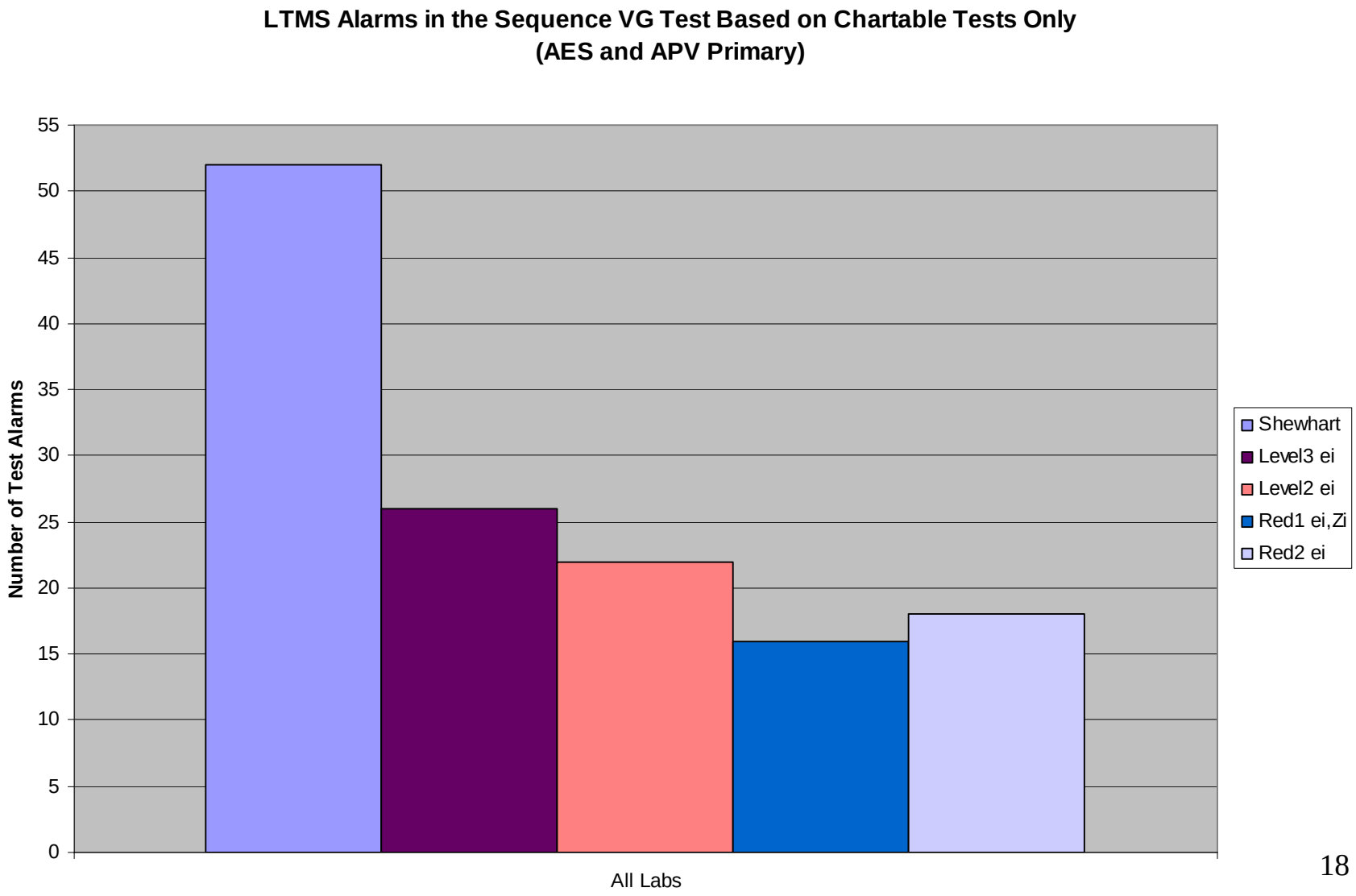
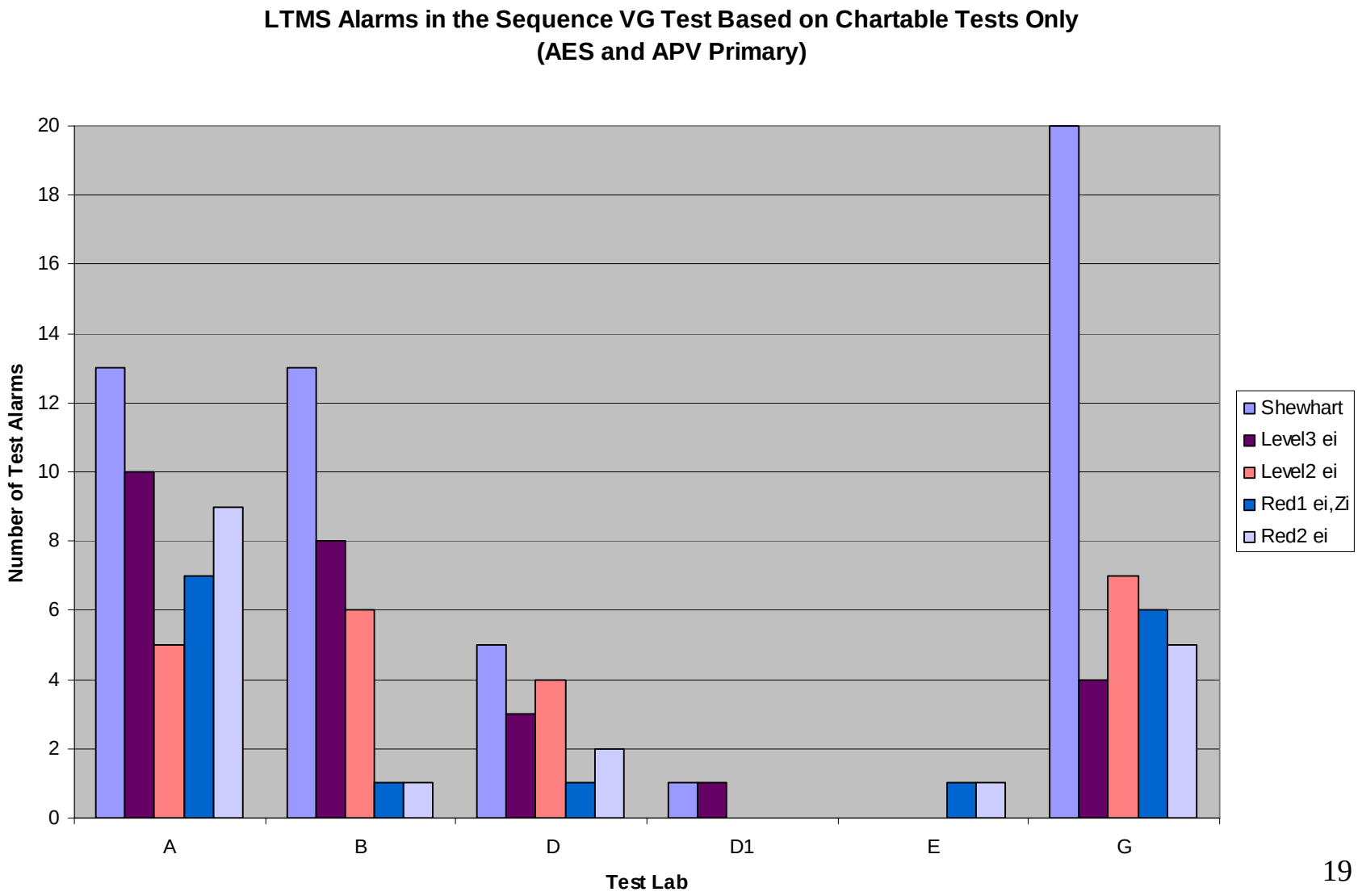
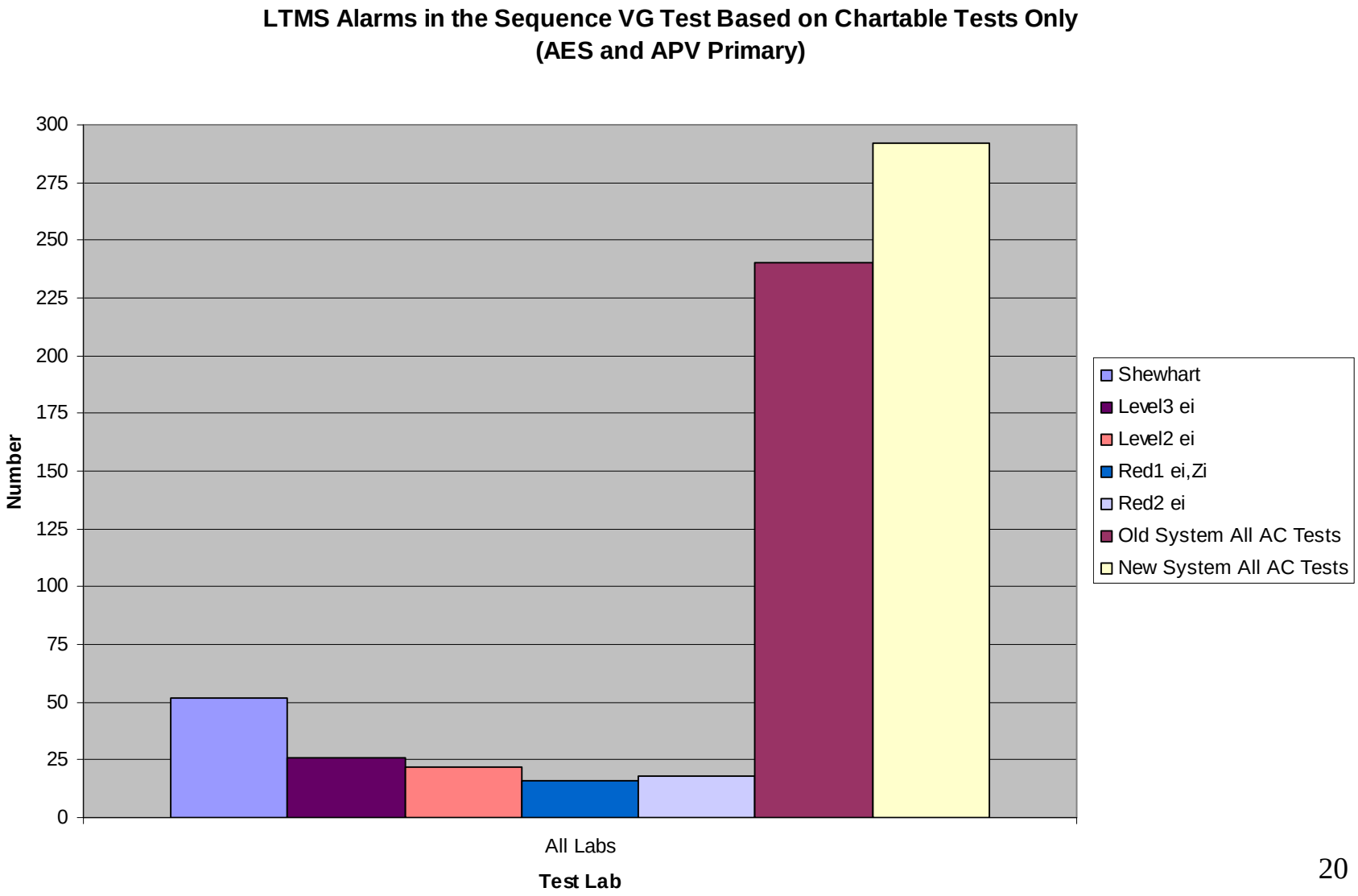


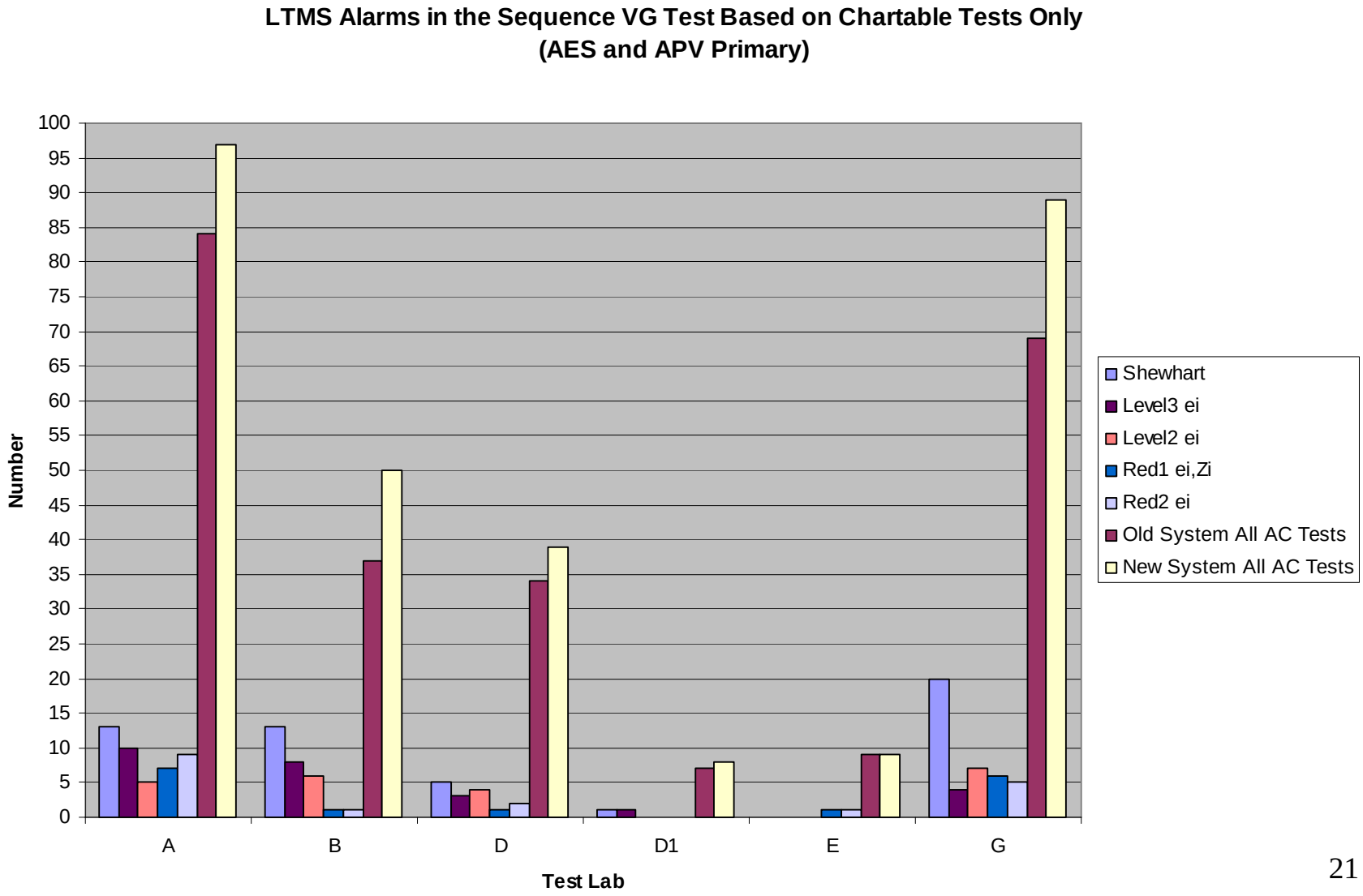
New LTMS for the VG



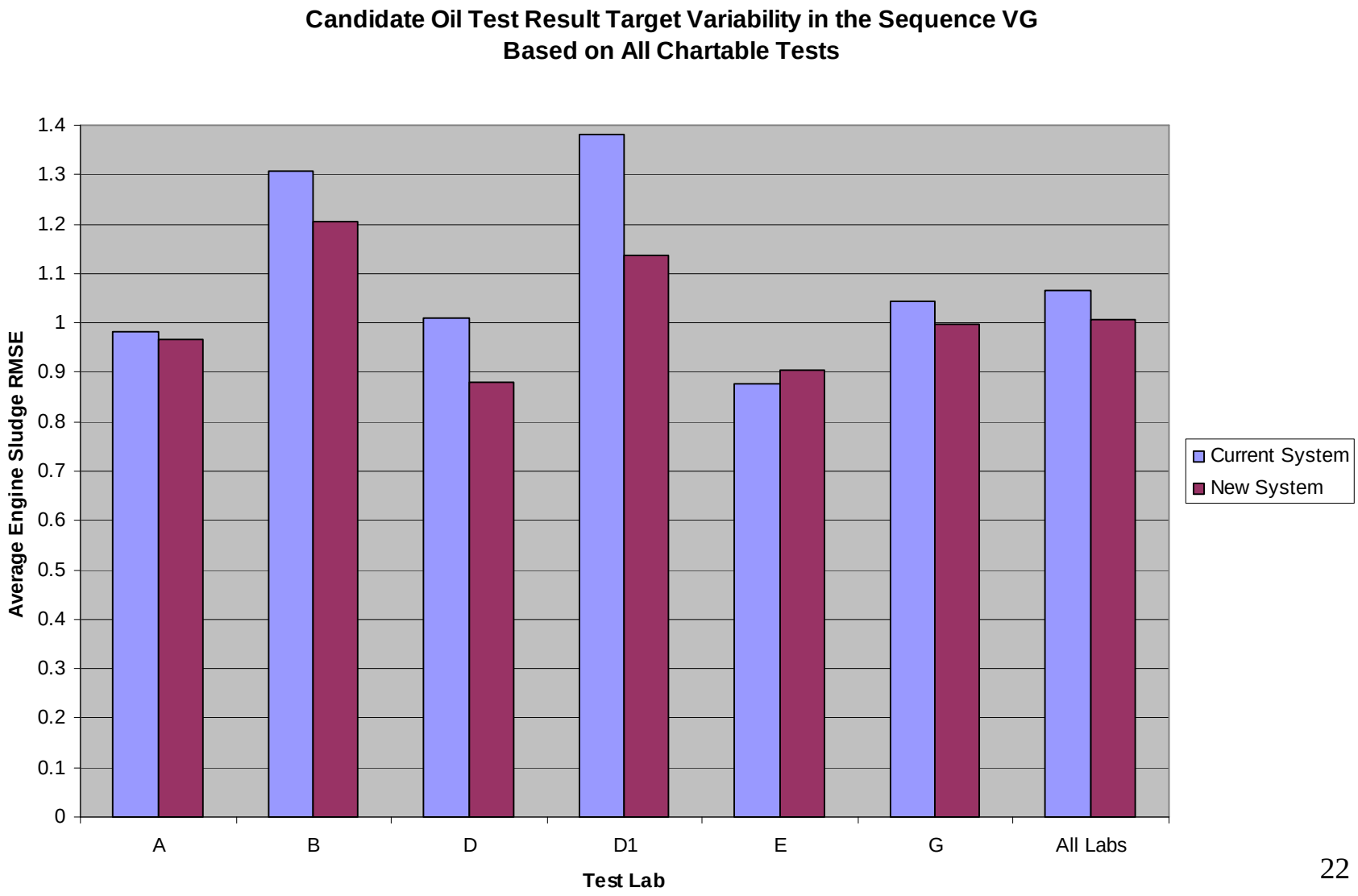
New LTMS for the VG



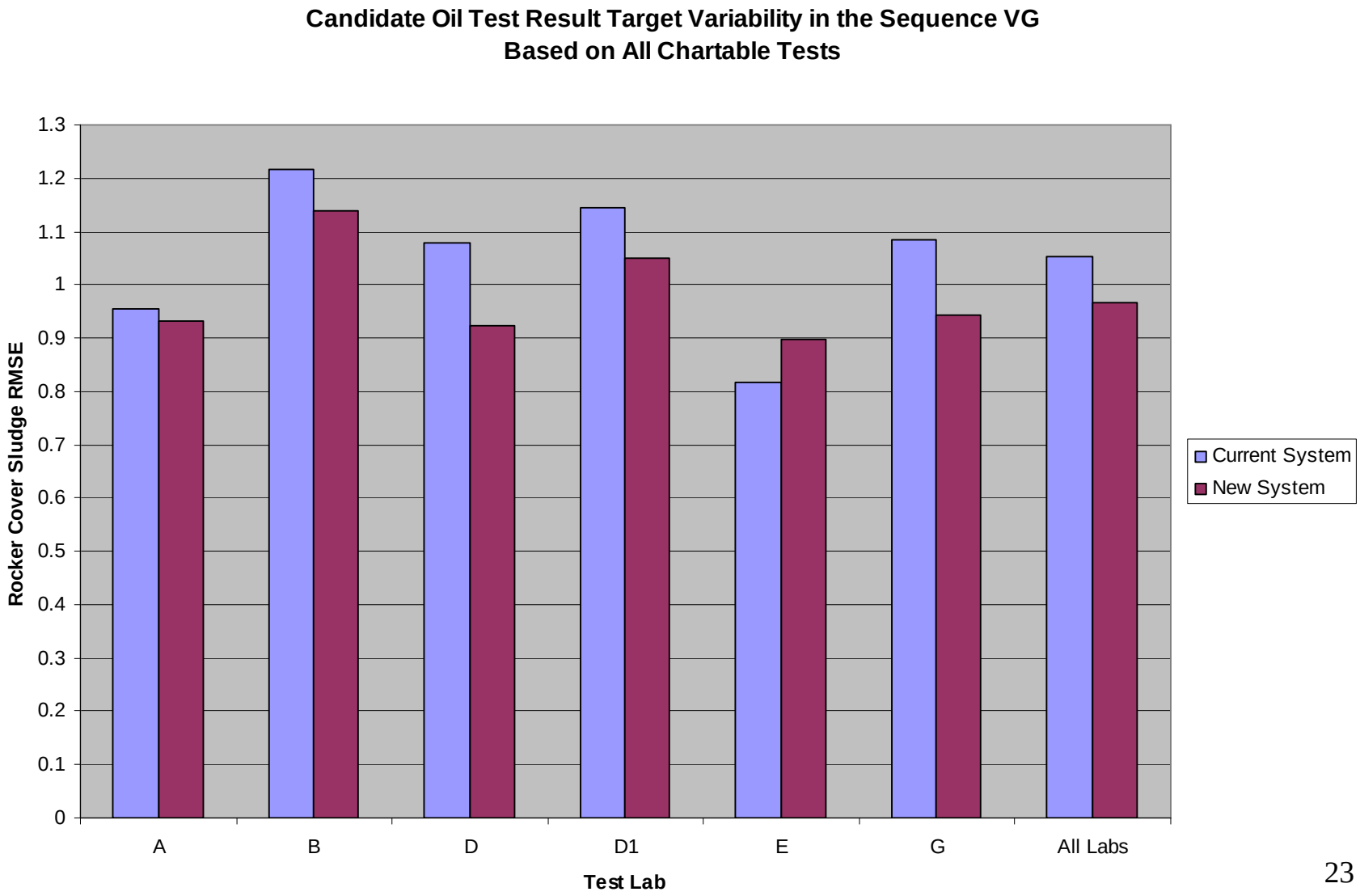
New LTMS for the VG



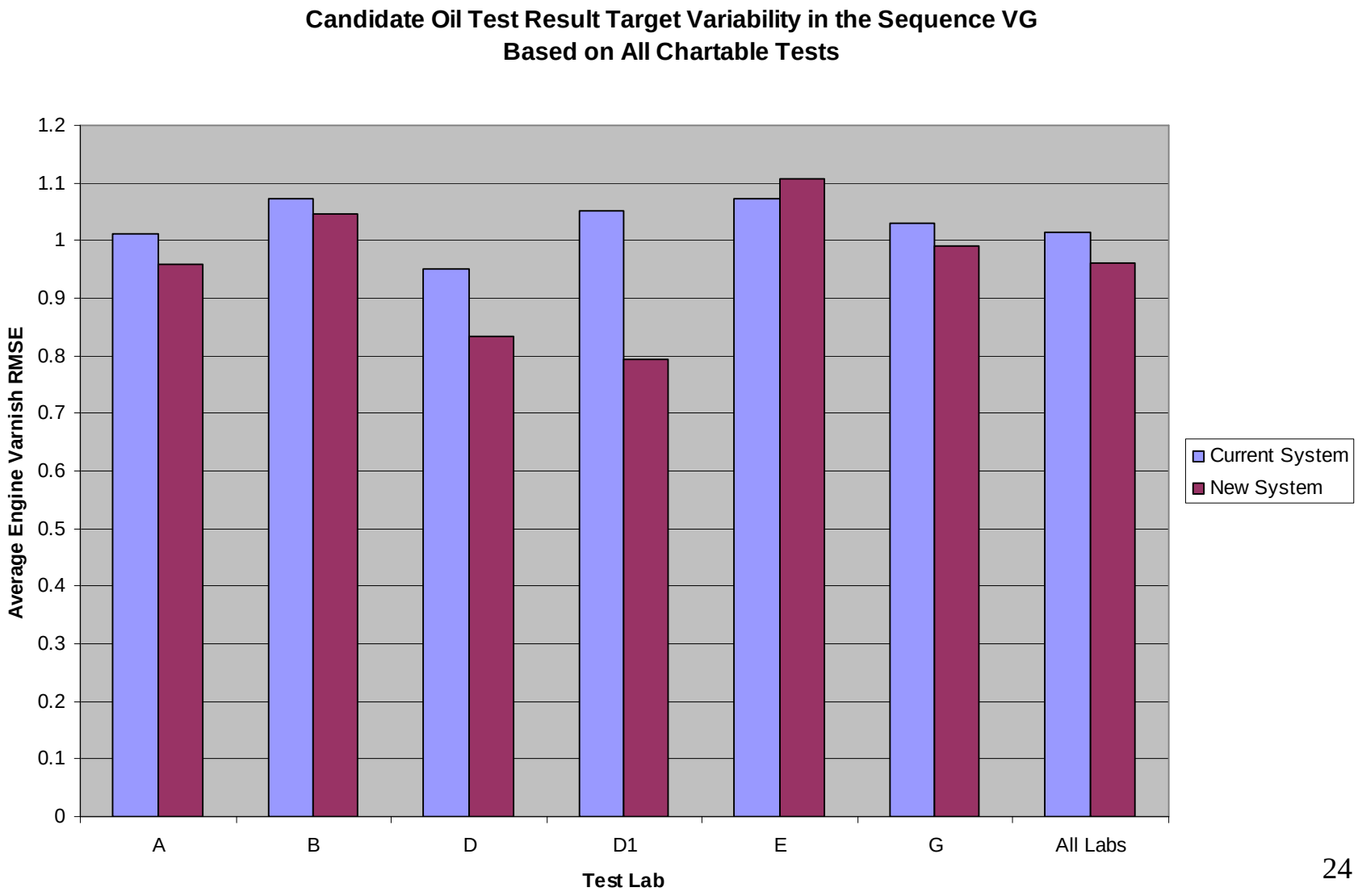
New LTMS for the VG



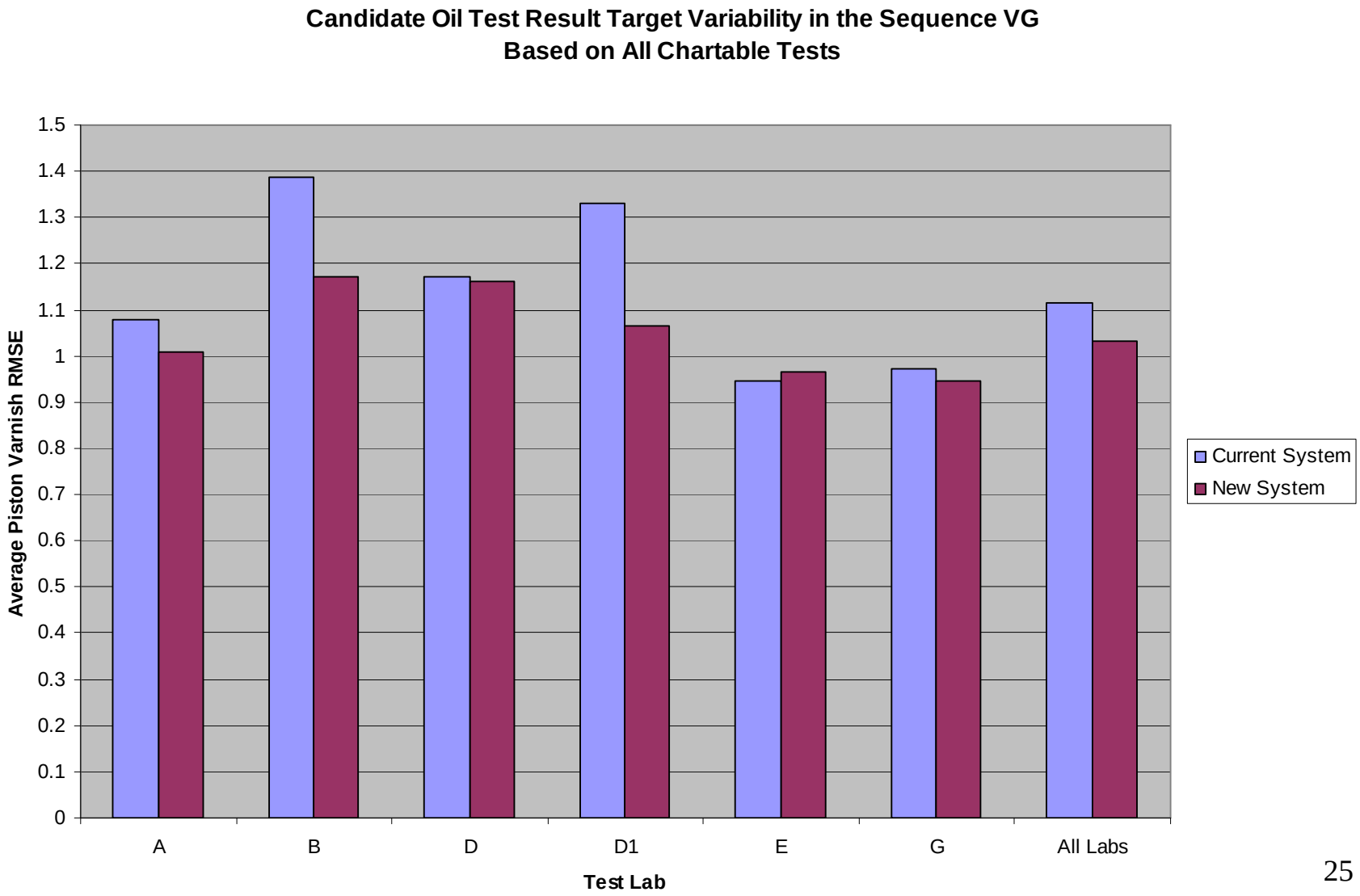
New LTMS for the VG



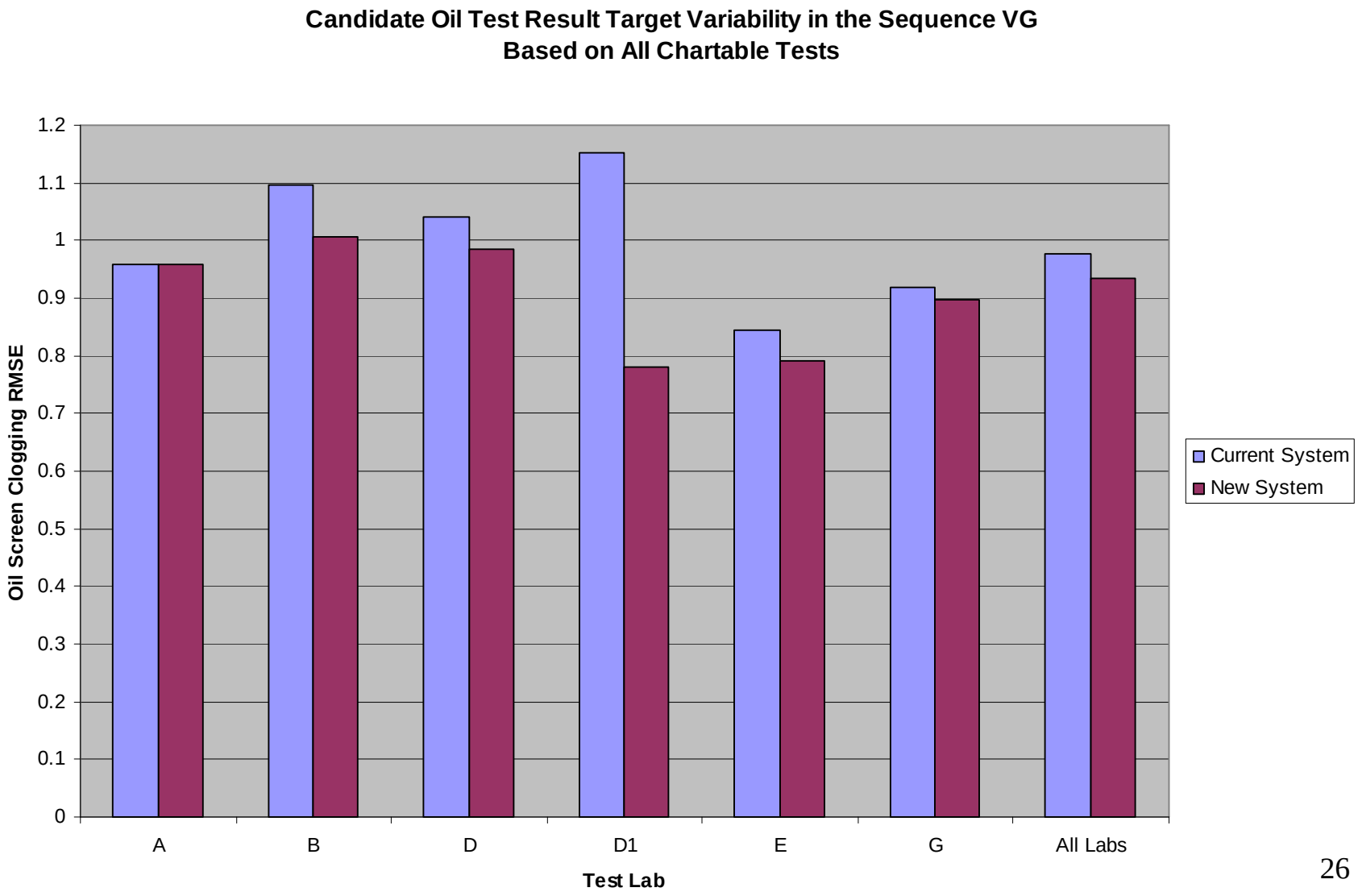
New LTMS for the VG



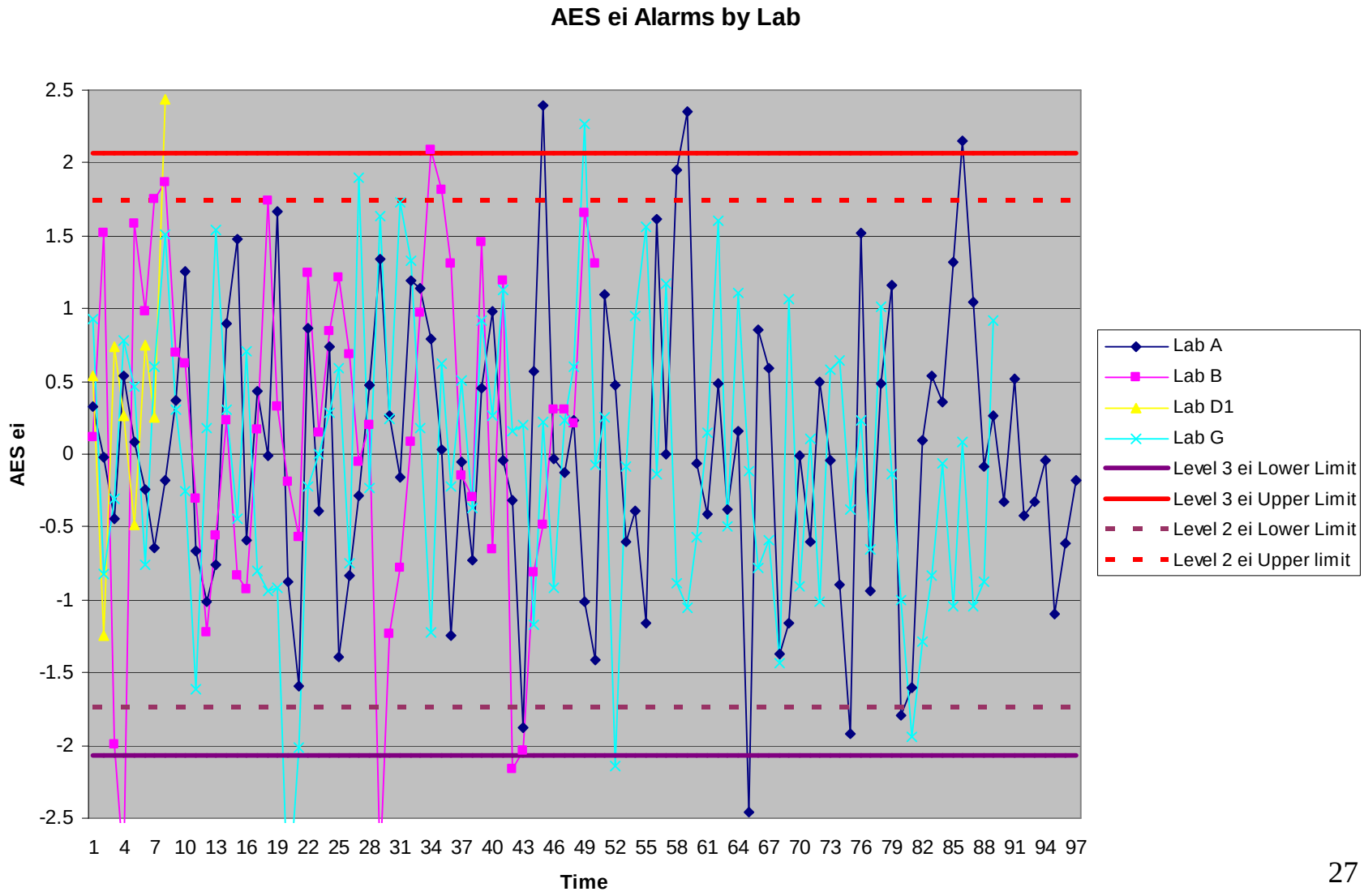
New LTMS for the VG



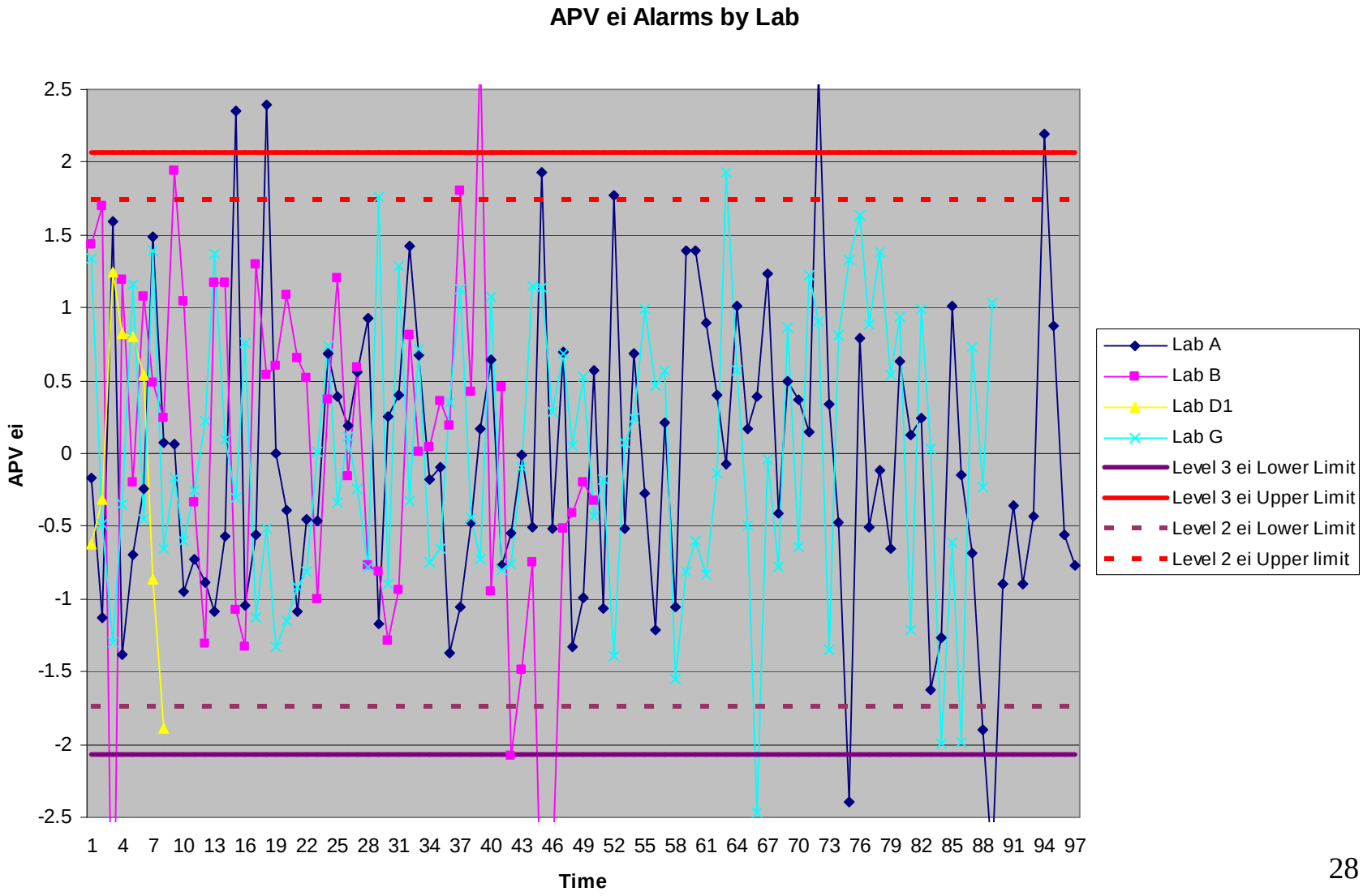
New LTMS for the VG



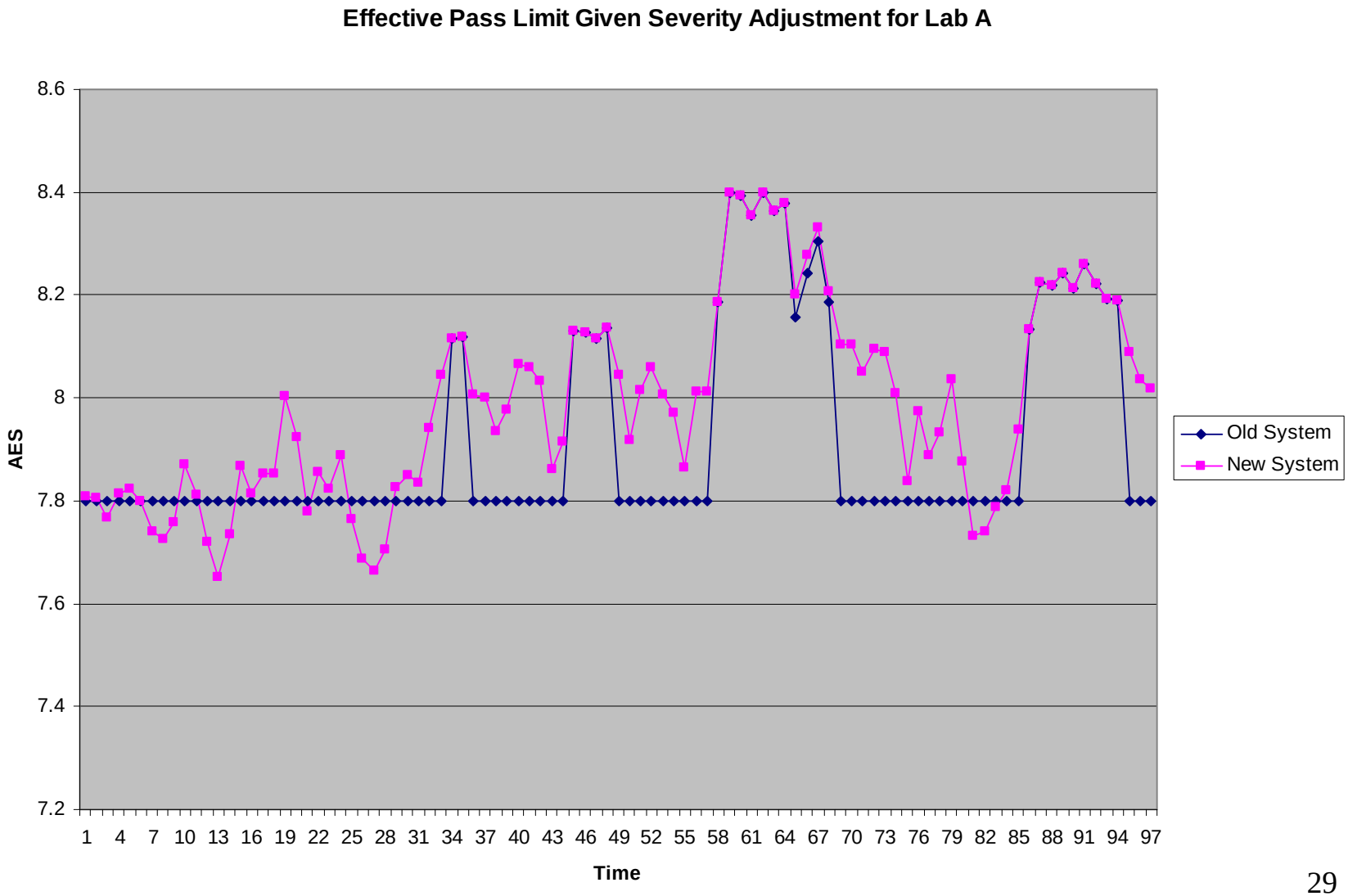
New LTMS for the VG



New LTMS for the VG



New LTMS for the VG



New LTMS for the VG

- Wow! There are A lot of Slide
- For More we Can View the Spreadsheet

Take a Breathe

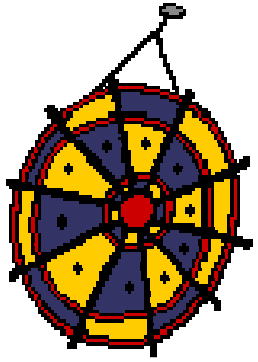
- Any Questions

Next Steps

- Review, Absorb, Cry
- Set Final
  - Zi and ei limits
  - Reference Interval Requirements
- Schedule an Implementation Meeting?
- Implement … ?
- Official Calculations Would be Done by the TMC and Start with “Next” Reference after Adoption

Additional Slides

LTMS Introduction



- What is LTMS?
  - Control Charting System that Monitors Both Bias and Precision for Both Abrupt Changes and Consistent Trends
  - Accuracy = Function(Bias, Precision)

- Why LTMS?
  - Maintain Calibration ➔ Protect Quality
  - X Special Causes ➔ Reduce Time/Cost

  - LTMS is a major prerequisite to fair, unbiased, cost effective candidate testing

LTMS Introduction

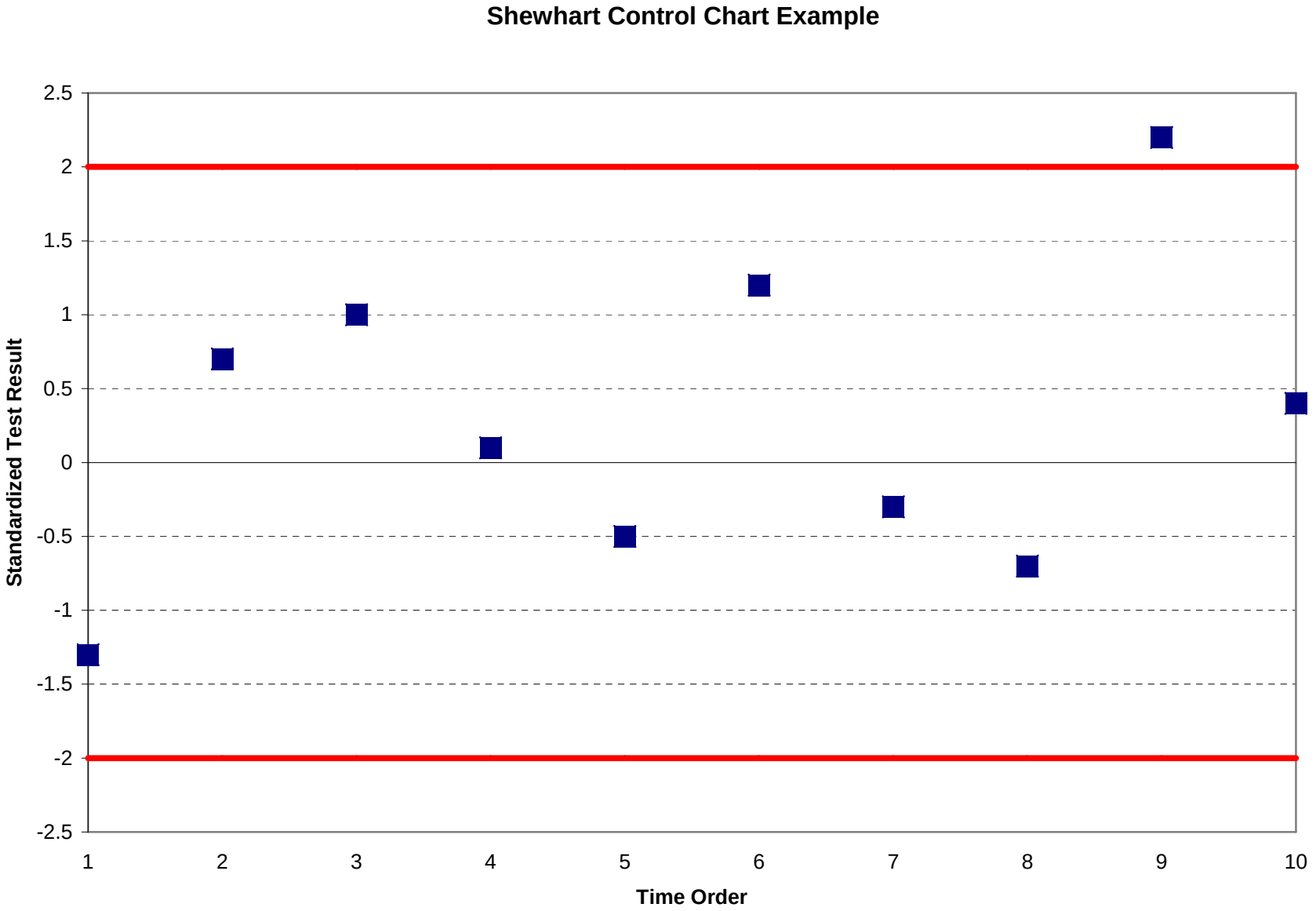
- Important Notes
  - LTMS does not solve problems
    - It is a tool to help solve problems
    - It is a tool to facilitate ‘fair’ testing
  - LTMS is at the mercy of bad practices
    - LTMS more effective under sound practices
  - LTMS should serve its purpose and should not be altered to accommodate poorly developed and administered tests
  - LTMS is not for all tests
    - Some tests have extremely poor standardization practices

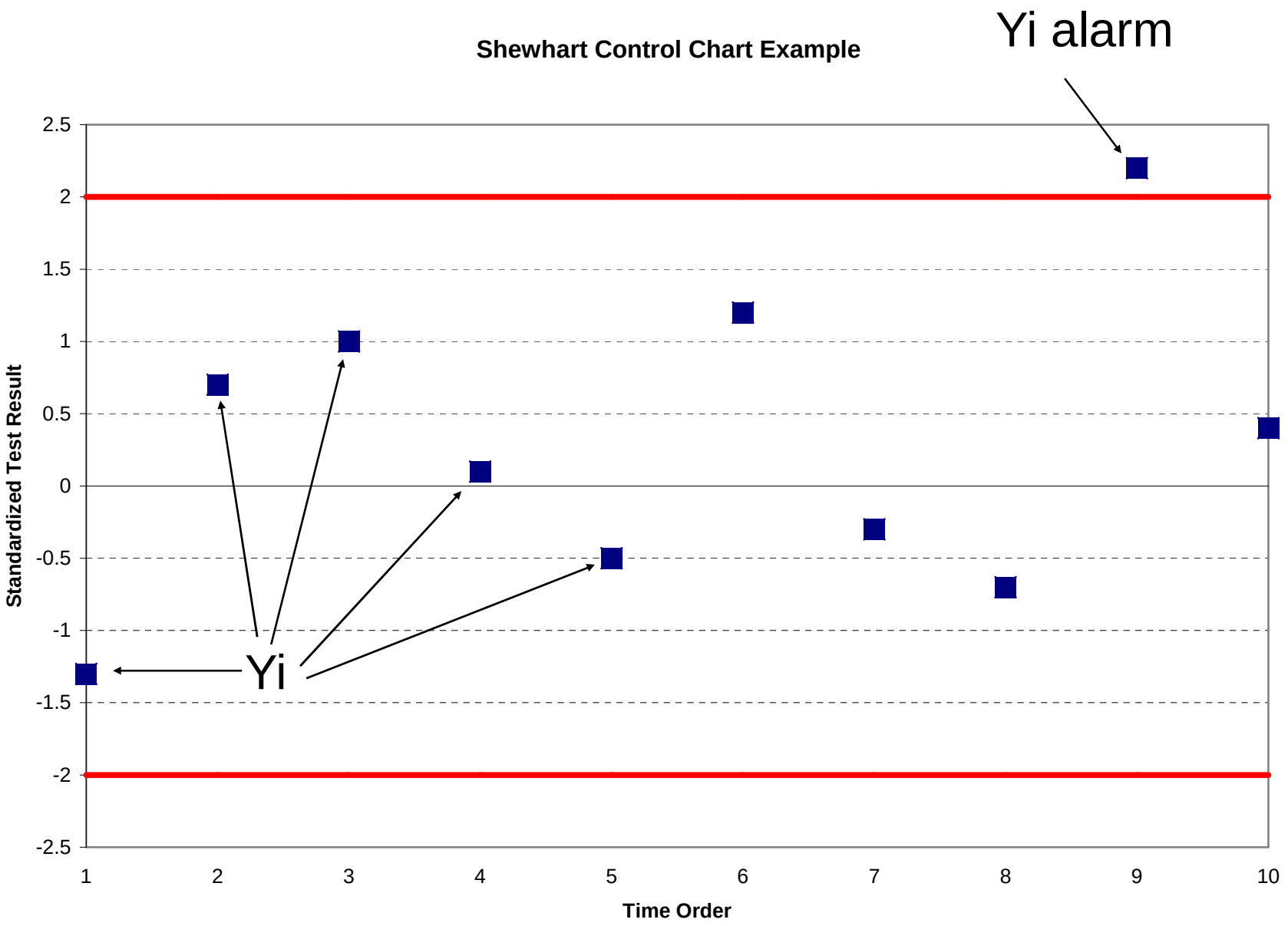
LTMS Introduction

- Elements of LTMS
  - Increase value of reference tests
    - Test to generate necessary data, NOT as punishment
  - Use of ALL operationally valid data
  - Actions = Function (Control Chart)
  - Use of fixed reference oil targets
  - Use of reference oils that mimic candidates
  - Standardized control charts
  - Near real time severity adjustments
  - Monitoring of different levels of severity (Engine, Stand, Lab, Industry)

LTMS Introduction

- What is a Control Chart?
  - Critical tool in LTMS process


Shewhart Control Chart Example
Standardized Test Result
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1
2
3
4
5
6
7
8
9
10
Time Order


Shewhart Control Chart Example
Yi alarm
Yi
Standardized Test Result
Time Order
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1
2
3
4
5
6
7
8
9
10

LTMS Introduction

- LTMS Prerequisites
  - Consistent, managed parts supply
  - Consistent, managed fuel supply
  - Consistent test operation and hardware
  - Consistent, managed supply of reference oils that mimic the performance of candidate oils
  - Approximate data normality (transformations)
  - Sufficient reference testing per lab
  - Baseline matrix or round robin or data history

LTMS Introduction

- Perspective
  - Why Do all This?
    - An Investment
    - Cost Effective Testing

- Poor Oils Must Fail and Good Oils Must Pass

LTMS Methodology

- Notation
  - k = Standard Deviation Multiplier for Control Chart Limit
  - X_i = Test Result at Test/Time i
  - T_i = Transformed Test Result at Test/Time i
    - Example: $T_i = LN(Y_i)$
  - Y_i = Standardized Test Result at Time/Test i
    - $Y_i = \frac{(T_i - \text{Reference Oil Mean})}{\text{Reference Oil Standard Deviation}}$
  - e_i = Prediction Error at Time/Test i
    - $e_i = Y_i - Z_{i-1}$

LTMS Methodology

- Notation
  - Z_i = Exponentially Weighted Moving Average of Y_i
    - $Z_i = (\lambda) Y_i + (1 - \lambda) Z_{i-1}$
  - Lambda = λ = Tuning parameter for EWMA

LTMS Methodology

- The Exponentially Weighted Moving Average (EWMA)

$$Z_i = (\lambda)\, Y_i + (1 - \lambda)\, Z_{i-1}$$

where: $0 <= \lambda <= 1$, Z_0 = Start

Z_i has a Memory, it Captures Process History

Z_i is the One-Step-Ahead Predictor of the Process

$$VAR(Z_i) = (\lambda / (2 - \lambda)) \times VAR(Y_i)$$

LTMS Methodology

- EWMA Example (Set $\lambda = 0.3$)

  $Z_i = (\lambda) Y_i + (1 - \lambda) Z_{i-1}$

$Y_1 = 0.5$

$Z_1 = (0.3)(0.5) + (0.7)(0) = 0.15$

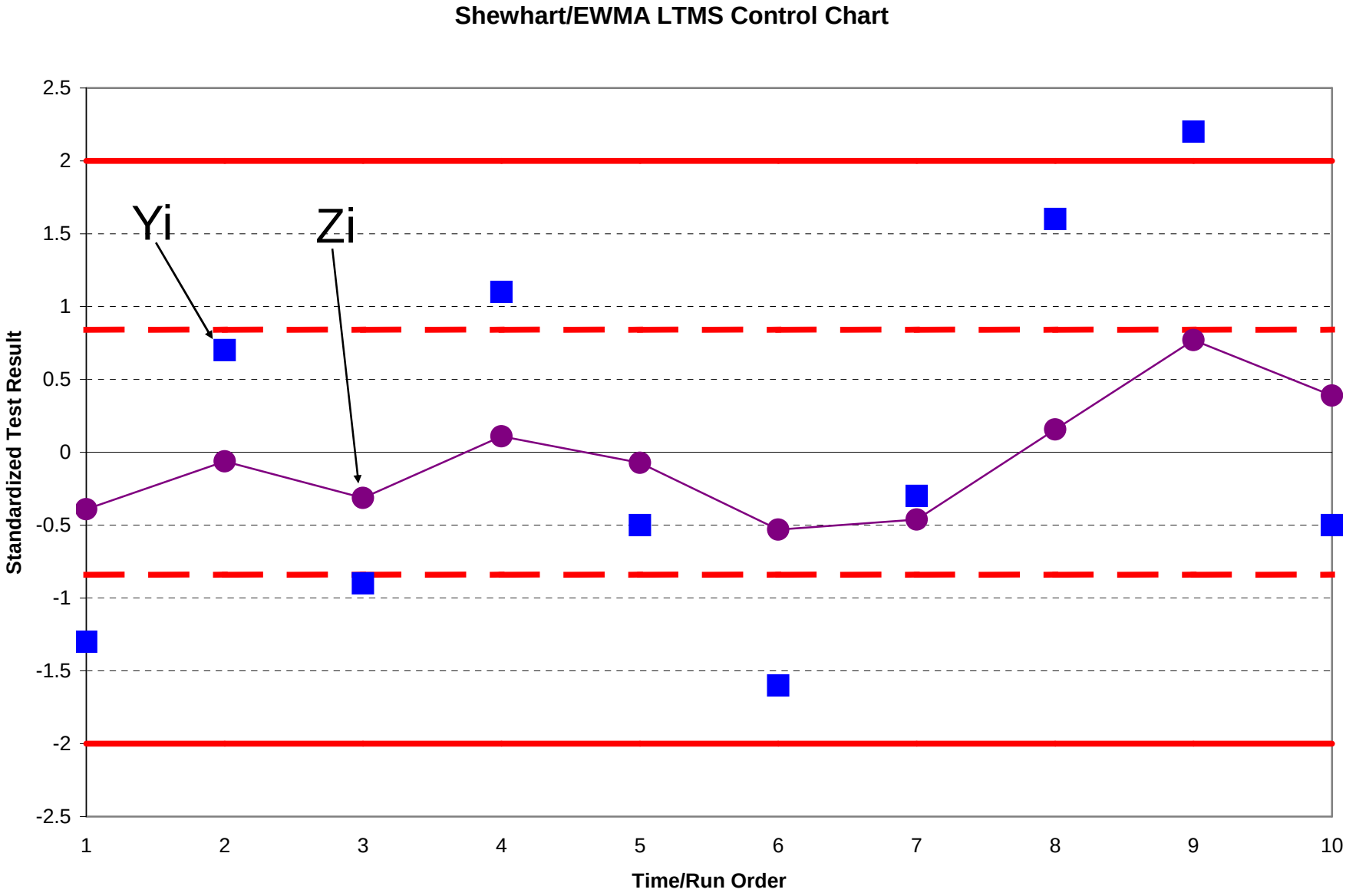
$Y_2 = 1.0$

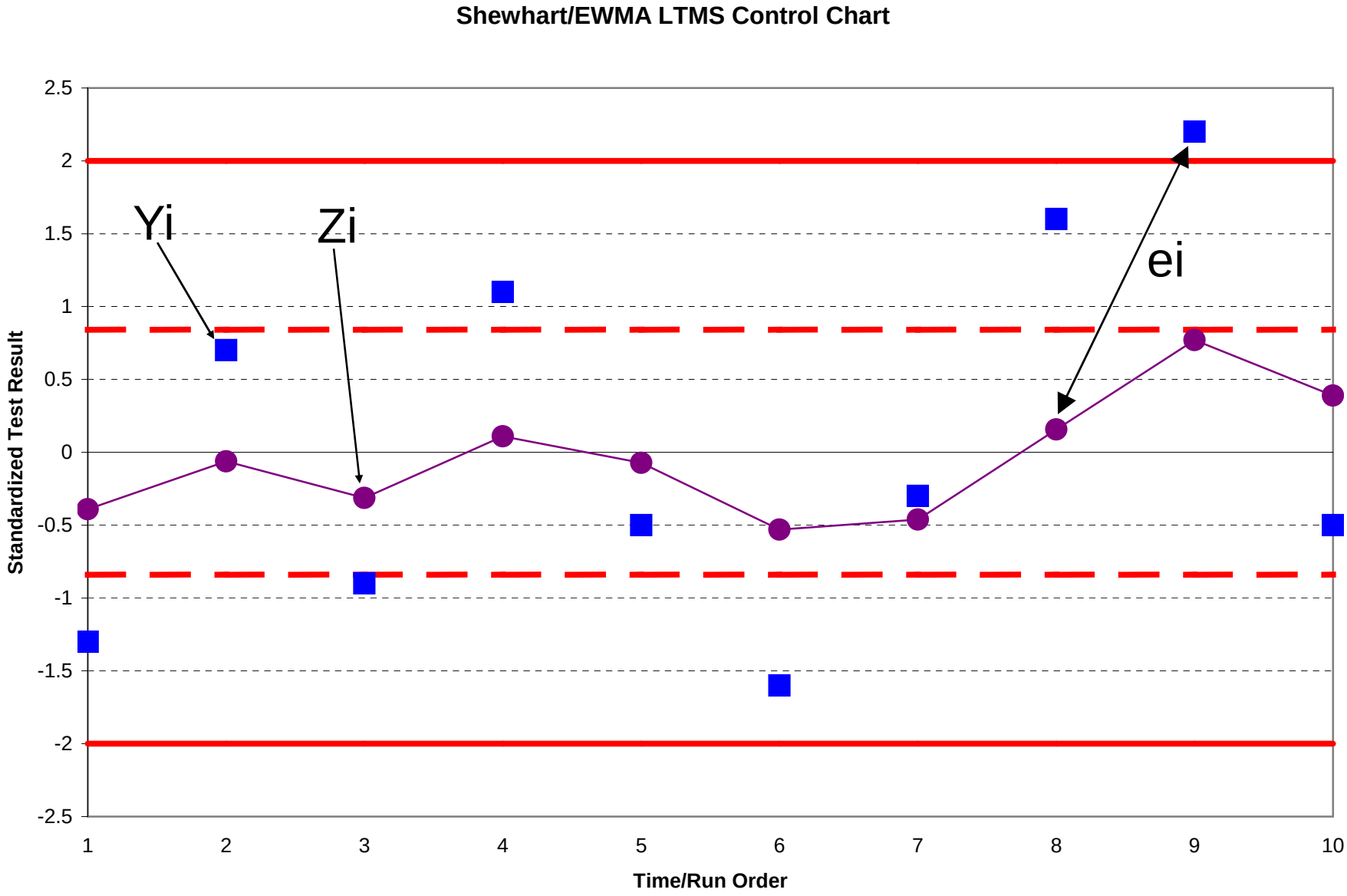
$Z_2 = (0.3)(1.0) + (0.7)(0.15) = 0.405$

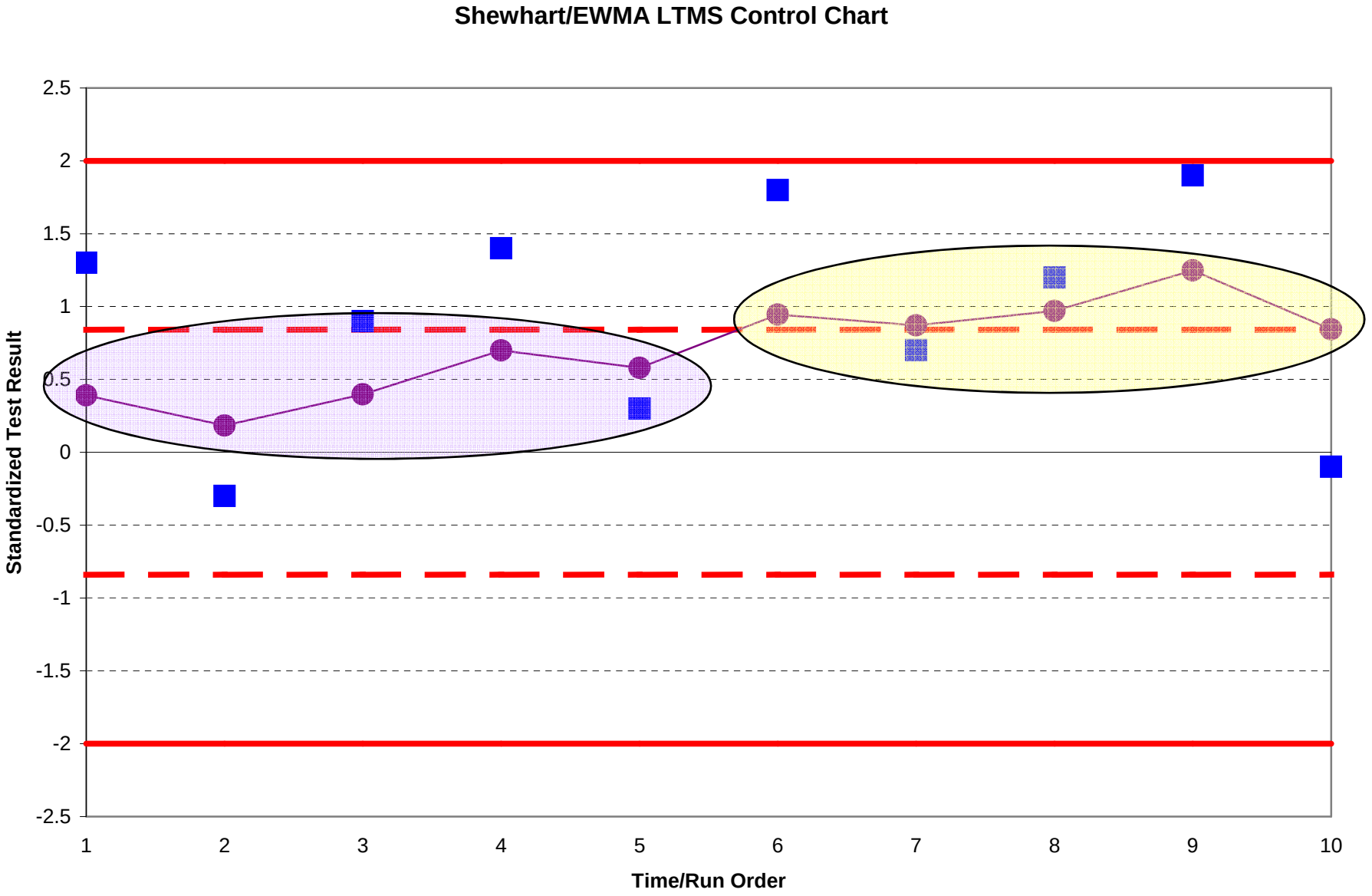
$Y_3 = 0.75$

$Z_3 = (0.3)(0.75) + (0.7)((0.405) = 0.5085$

$Z_3 = (0.3)(Y_3) + (0.3)(0.7)Y_2 + (0.3)(0.7)(0.7)(Y_1) + (0.7)(0.7)(0.7)(Z_0)$


Shewhart/EWMA LTMS Control Chart
Yi
Zi
Standardized Test Result
Time/Run Order
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1
2
3
4
5
6
7
8
9
10


Shewhart/EWMA LTMS Control Chart
Yi
Zi
ei
Standardized Test Result
Time/Run Order
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1
2
3
4
5
6
7
8
9
10


Shewhart/EWMA LTMS Control Chart
Standardized Test Result
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1
2
3
4
5
6
7
8
9
10
Time/Run Order

LTMS Methodology

- e_i Example
  $e_i = Y_i - Z_{i-1}$

$Z_{10} = 2.5$
$Y_{11} = 2.5$ $\quad\quad$ $e_{11} = 2.5 - 2.5 = 0.0$

No Problem

$Y_{12} = 0.0$ $\quad\quad$ $e_{12} = 0.0 - 2.5 = -2.5$

Problem

Continuous SA

- Why the SPOTLIGHT on Continuous SA?
  - Because Why the Continuous SA?
    - Because Best Overall ‘GOODNESS’
    - Do we Wish to Review?

Measure of Goodness

- Spread of Data Around Expected Result
  - Accuracy
- Mean-Squared Error (MSE)
  - MSE = E{(Actual – Expected)^2}
    - MSE = E{(Actual – Predicted)^2}
  - MSE = Variance + (Bias)^2
    - MSE = Variance + (Uncorrected Process Bias)^2
- What Should We Expect?
  - We Expect Test Results, Corrected or Uncorrected, to be on Target with Minimal Variance Around the Target
  - We Expect a Small MSE

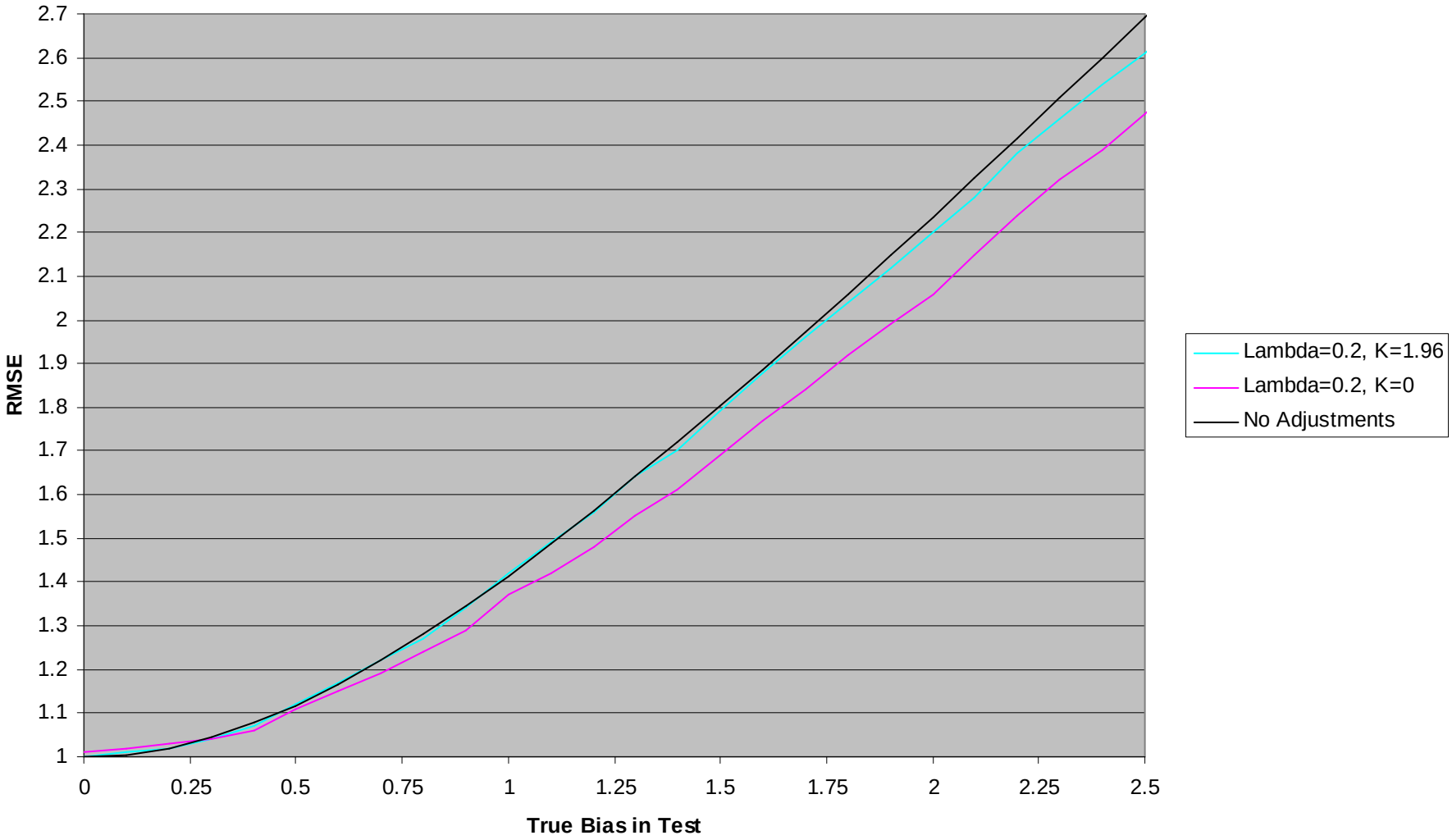
Calculation Method

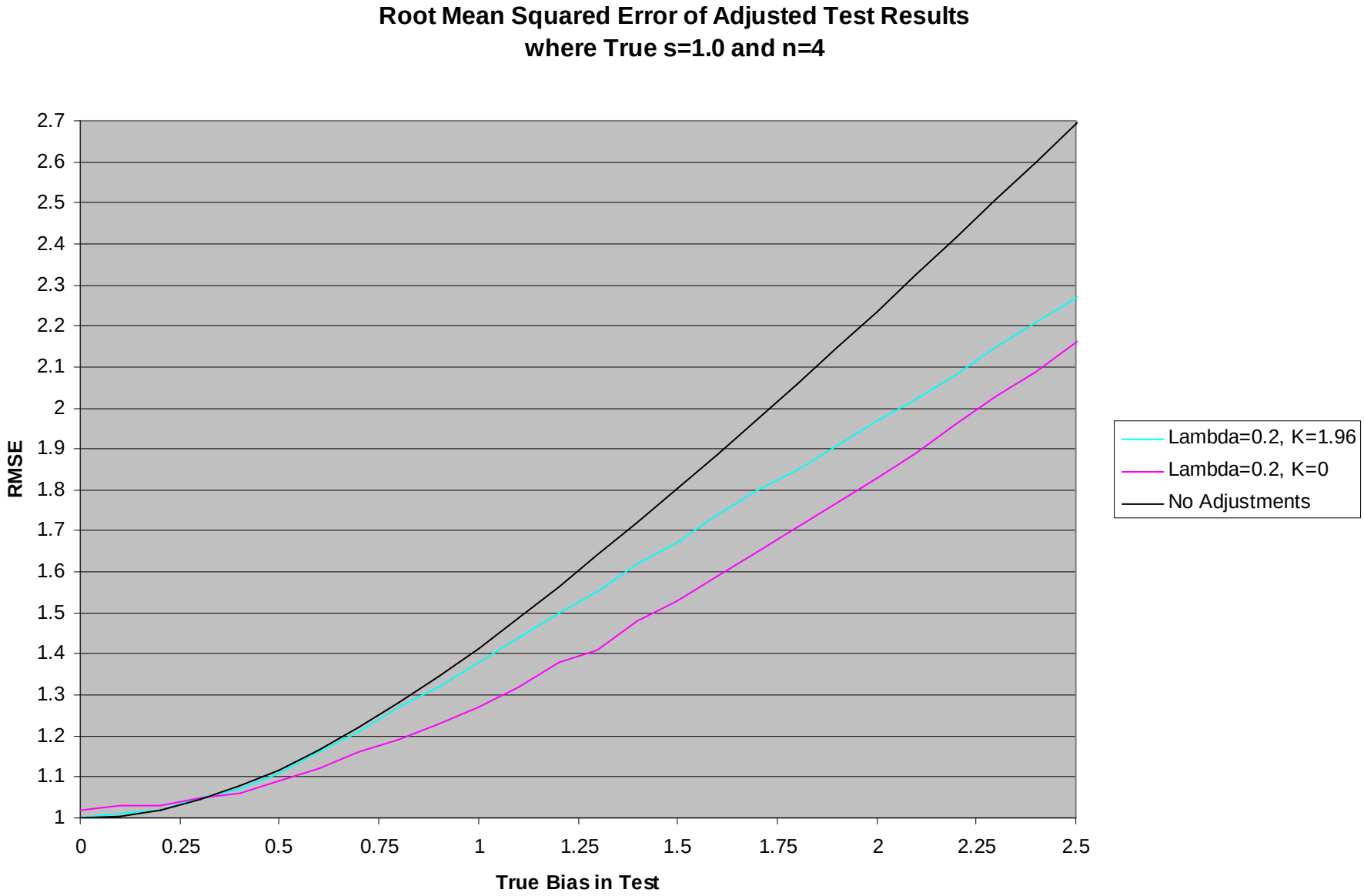
- Compare MSE of Different Adjustment Methods Over Different Bias (Test Shift) Scenarios
  - Theoretical Calculation for Situation of No Bias
  - 10,000 Simulations in Cases of Bias (Test Shift)
- Mean Target is Zero (0) and True Standard Deviation is One (1)
- Comparisons are Made at 2, 4, and 10 Tests
  - What is the average variability of my test results after correcting after 2, 4 and 10 tests after a shift
  - It is Very Unlikely that No Shifts Occur Within 10 Reference Tests

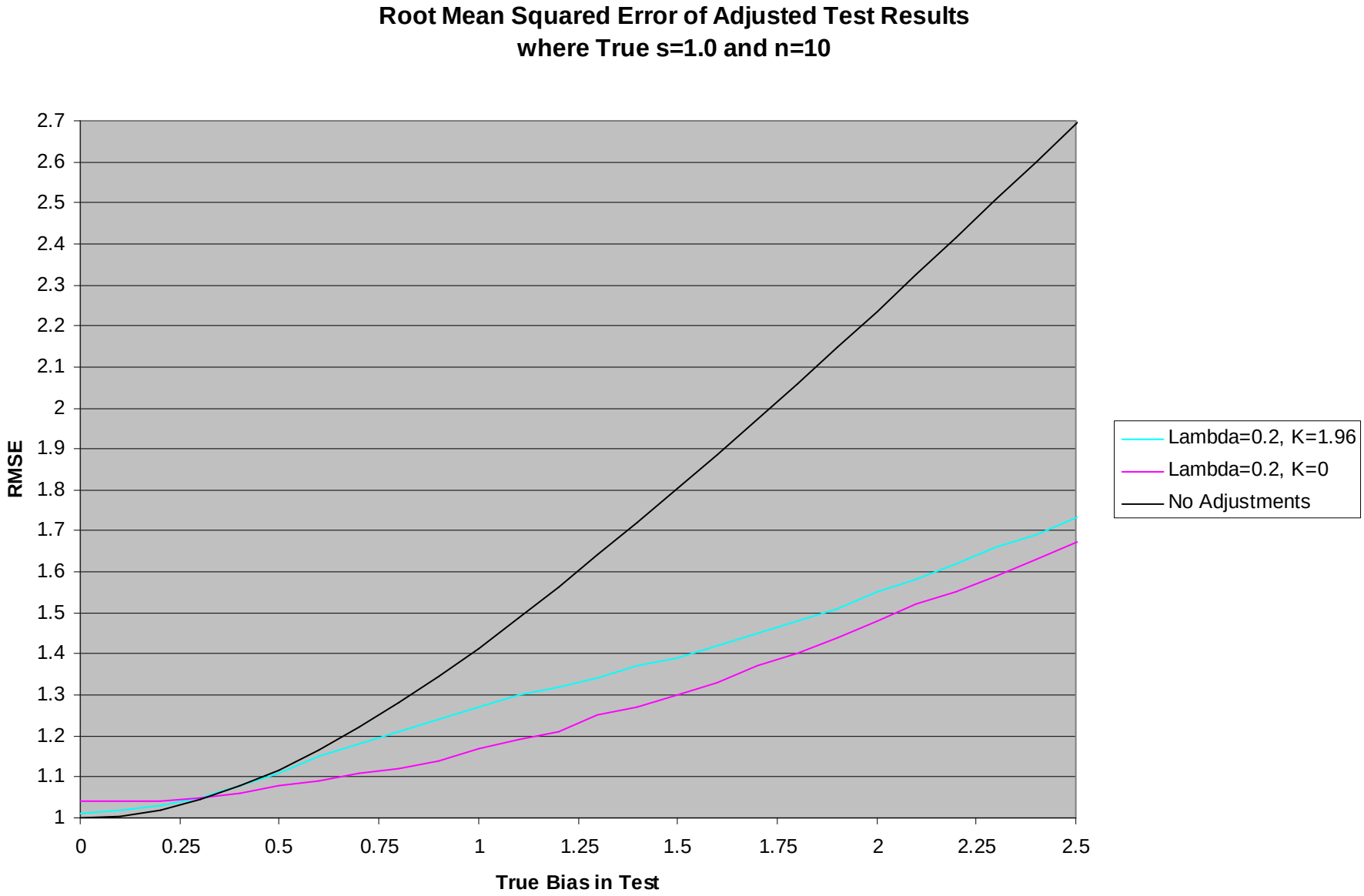
EWMA Continuous Adjustment

- IFF No Bias, No Adjustment Best for RMSE
  - BUT
    - Differences in RMSE are Very, Very Small
    - Better RMSE for EWMA from 0.2 to 0.4 Bias Depending on n and Lambda
    - Given Historical Data, Probability of Test Shifts and Lab Bias is High
- Best Lambda Depends on Size of Shift/Bias
  - Bias Less than 0.5
    - Small, $\lambda = 0.1$ or $\lambda = 0.2$, Better
  - Bias Greater than 0.75
    - Larger, $\lambda = 0.3$ or $\lambda = 0.4$ Better
  - Selection of $\lambda = 0.2$ Appears to be a Good Compromise

Root Mean Squared Error of Adjusted Test Results
where True s=1.0 and n=2

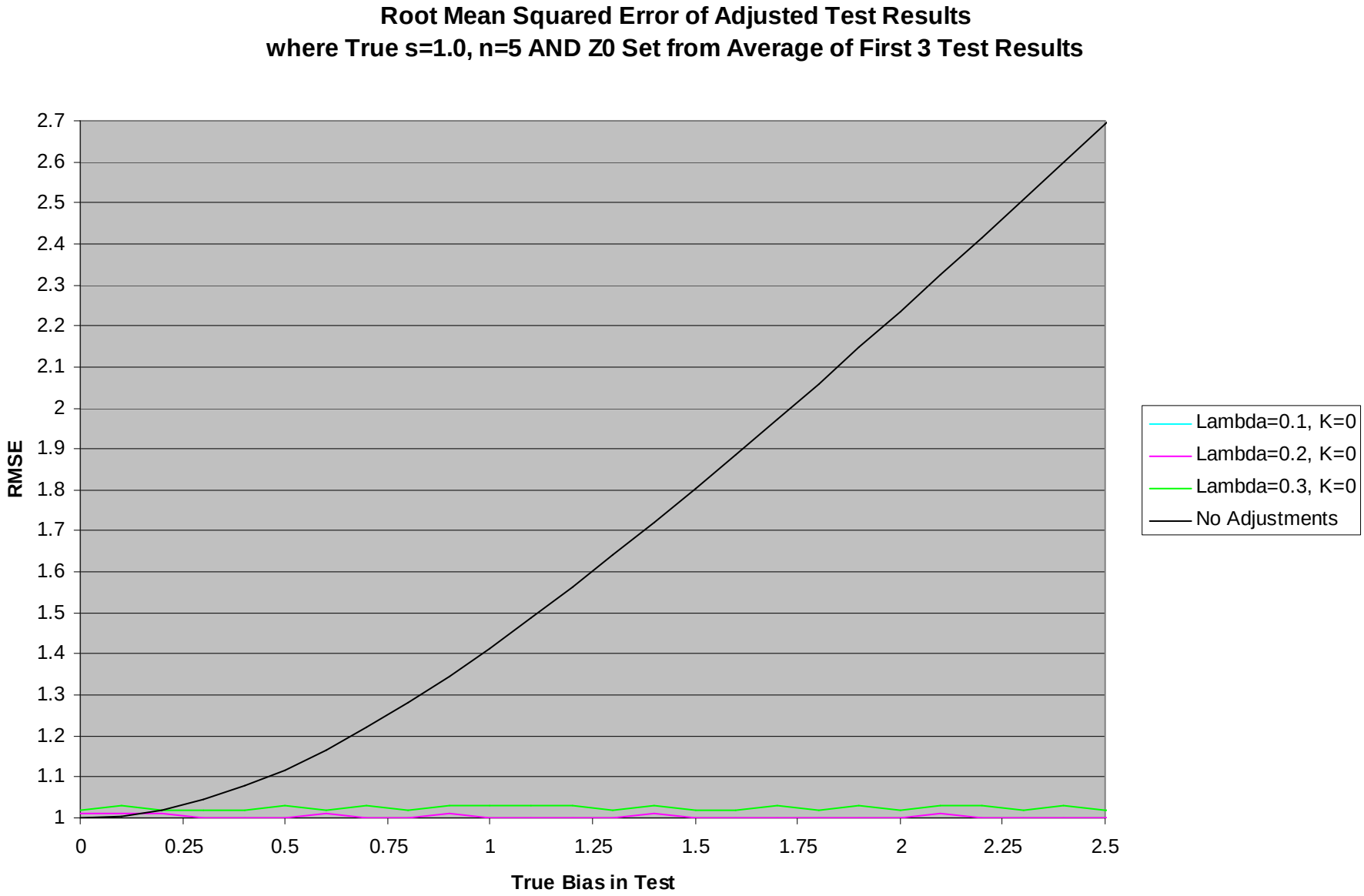



Root Mean Squared Error of Adjusted Test Results
where True s=1.0 and n=4
RMSE
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
2.25
2.5
True Bias in Test
Lambda=0.2, K=1.96
Lambda=0.2, K=0
No Adjustments


Root Mean Squared Error of Adjusted Test Results
where True s=1.0 and n=10
RMSE
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
2.25
2.5
True Bias in Test
Lambda=0.2, K=1.96
Lambda=0.2, K=0
No Adjustments

Fast Start to the EWMA

- Set Z0 to the Average of the First 3 Reference Tests
- Results in an Overall Reduction of the RMSE


Root Mean Squared Error of Adjusted Test Results
where True s=1.0, n=5 AND Z0 Set from Average of First 3 Test Results
RMSE
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
2.25
2.5
True Bias in Test
Lambda=0.1, K=0
Lambda=0.2, K=0
Lambda=0.3, K=0
No Adjustments

Attachment 5

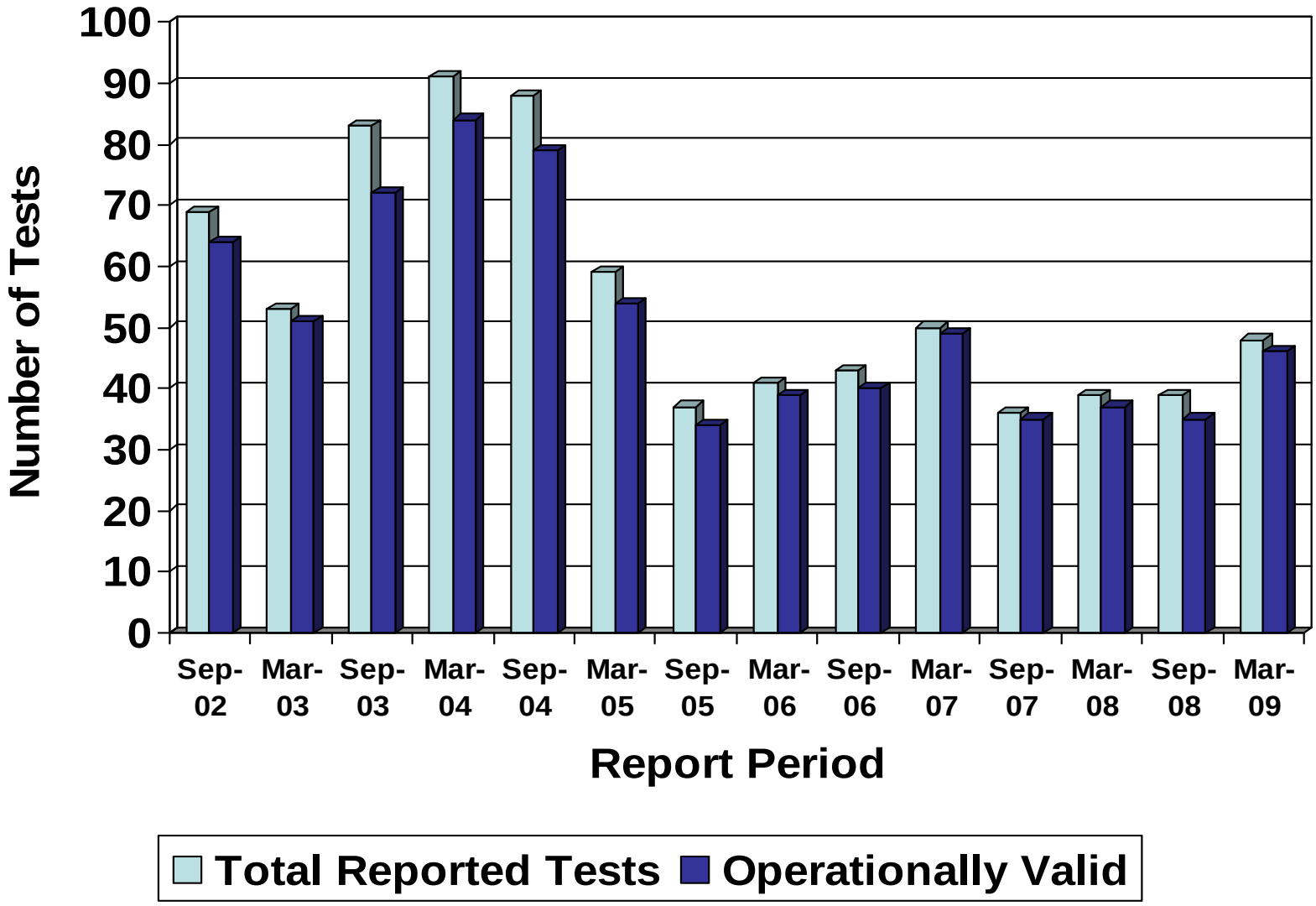
Sequence VG S.P.
Presentation to Subcommittee
D02.B
DRAFT

Prepared By: Andrew Ritchie, S.P. Chairman

May 13th 2010

Sequence VG S.P. Report

Candidate Test Activity



Sequence VG S.P. Report
Reference Oil Update

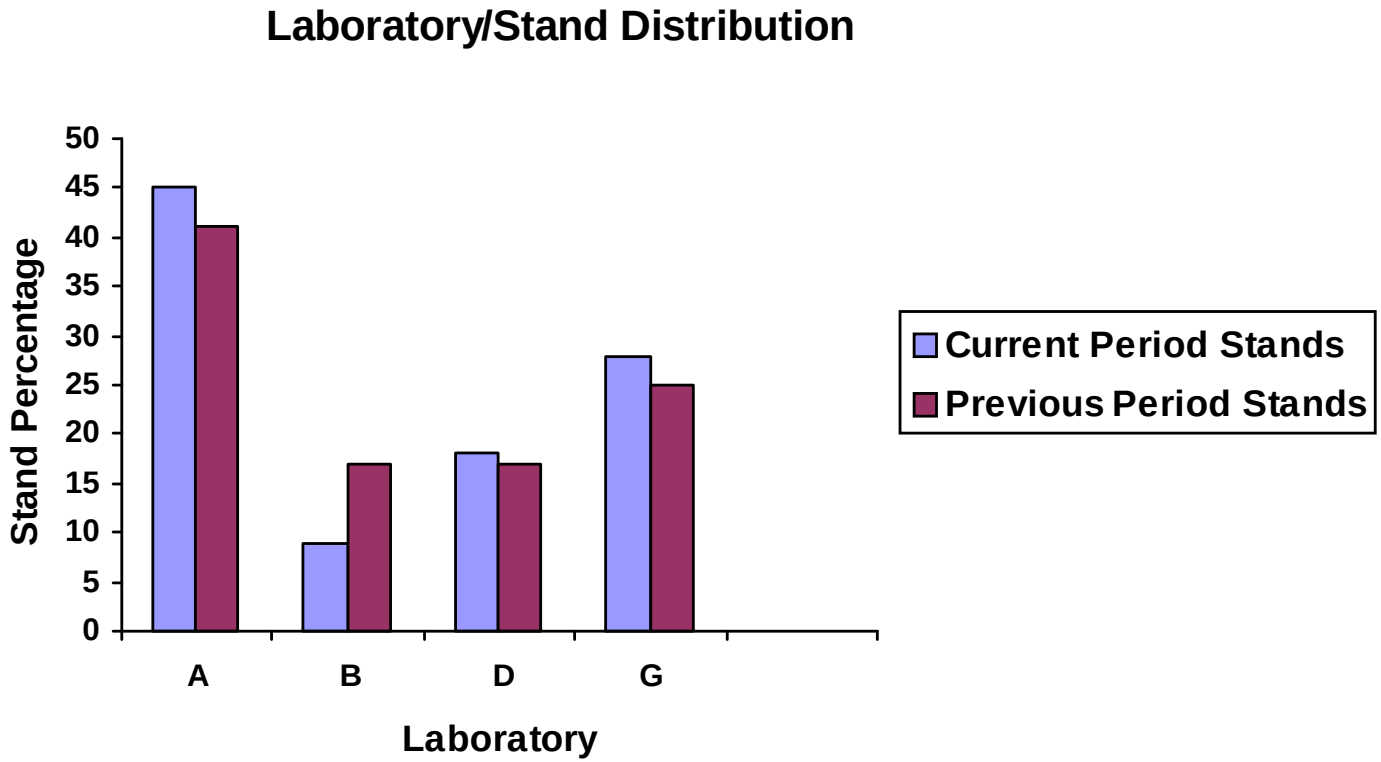
- **There is ample supply (3 years or more) of all active VG reference oils:**
  - ***925-3*** *SAE 5W30 failing reference oil*
  - ***1006-2*** *SAE 5W30 passing reference oil*
  - ***1007*** *SAE 5W30 passing reference oil*
  - ***1009*** *SAE 5W30 borderline passing reference oil*

Sequence VG S.P. Report
Panel Activity

- **The VG Surveillance panel met May 13th 2010.**
  - **Surveillance panel will meet next 2H 2010.**
  - **Panel is working on the approval of a new fuel batch.**

Sequence VG S.P. Report

LTMS Laboratory/Stand Distribution



Sequence VG S.P. Report

Industry Reference Severity Summary

6 month time frame

Variable	Pooled s All Oils	Mean Delta/s	Based on	Delta in Reported Units
RAC	0.23	-0.09	8.0	-0.02
AES	0.55	0.00	7.8	0.00
APV	0.28	-0.29	7.5	-0.08
AEV	0.13	0.08	8.9	0.01
OSCR	0.51	-0.71	20	-6.8

Sequence VG S.P. Report

Sequence VG S.P. Scope

The Sequence V Surveillance Panel is responsible for the surveillance and continued improvement of the Sequence VG test documented in ASTM Standard D6593 as updated by the Information Letter System. Data on test precision and laboratory versus field correlation will be solicited and evaluated at least every six months. Improvements in rating technique, test operation, test monitoring and test validation will be accomplished through continual communication with the Test Sponsor, ASTM Test Monitoring Center, ASTM B0.01, Passenger Car Engine Oil Classification Panel, ASTM Light Duty Rating Task Force, ASTM Committee B0.01, ACC Monitoring Agency and CRC Motor Rating Methods Group. Actions to improve the process will be recommended when deemed appropriate based on input from the preceding. Industry transition to new engine hardware batches will be monitored and redistribution of existing hardware facilitated to accomplish uniform industry implementation. Development and correlation of updated test procedures with previous test procedures will be reviewed by the panel. This process will provide the best possible test procedure for evaluating automotive lubricant performance with respect to the lubricant's ability to prevent engine sludge, engine varnish, oil screen plugging, oil ring clogging and ring sticking.

Sequence VG S.P. Report

Sequence VG S.P. Objectives

Objectives	Target Date
1. Prepare and evaluate a new batch of SVGM2 fuel.	Complete by YE 2010

Sequence VG S.P. Report

Information **Item for Subcommittee B/B01**

- ***Efforts are underway to secure a new fuel batch for the Sequence VG.***

Attachment 6

Ford Motor Company
Ford Customer Service Division
Service Engineering Office

Diagnostic Service Center II
1800 Fairlane Drive
Allen Park, mi. 48101

May 6, 2010

Thom Smith
PCEOCP Chairman
The Valvoline Company
P.O. Box 14000 VL-2
Lexington, Ky. 40512-4001

Dear Thom,

At the last PCEOCP meeting the group requested the submission of a candidate for a GF-5 reference oil that met at least the Sequence VID and Sequence IIIG ILSAC GF-5 limits. I'd like to submit the attached data from a candidate oil for consideration. This is an SAE 5W-20 oil that passes both the Sequence IIIG and VID and most of the other GF-5 tests. This oil doesn't meet the emulsion retention requirements of ILSAC GF-5. The test data provided are single tests, but we're confident in the data as we've run a number of tests on this DI chemistry with passing results on the Sequence VID, IIIG, VG, IVA, etc. The additional data is proprietary and can not be shared.

Please circulate this information to the PCEOCP members and Surveillance Panel chairs for consideration and discussion at the next meeting.

If you have any question please contact me.

Sincerely

Ron Romano
Service Lubricants Technical Expert

SAE 5W-20 GF-5 Reference Oil Candidate

Performance Requirements	Specification	Test Results
ASTM Ball Rust (ASTM D6557)		
Average Gray Value	100 min	124
Sequence IIIG		
Viscosity Increase at 40 °C	150% max	81
Weighted Piston Deposits	4.0 min	4.0
Hot Stuck Piston Rings	0	0
Cam Plus Lifter Wear, Average	60 μm max	12
Sequence IIIGA		
Aged oil CCS Viscosity at -30°C	Report	7200
MRV TP-1, cP	1 grade up max	11400@ -30°C
Yield Stress, Pa	<35 max	<35
Sequence IIIB		
Phosphorus Retention, %	79 min	85
Sequence IVA (ASTM D6891)		
Average Cam Wear (7 position average)	90 μm, max	18
Sequence VG (ASTM D6593)		
Average Engine Sludge	8.0 min	9.5
Rocker Arm Cover Sludge	8.3 min	9.6
Average Engine Varnish	8.9 min	9.1
Piston Skirt Varnish	7.5 min	8.1
Oil Screen Clogging	15% max	1
Hot Stuck Compression Rings	0	0
Cold Stuck Rings	Report	0
Sequence VID (ASTM D7589)		
SAE 5W-20		
FEI SUM *	2.6% min	2.79
FEI 2 at 100 Hours	1.2% min	1.41
* FEI SUM = FEI at 16 hours + FEI at 100 hours		
Sequence VIII (ASTM D6709)		
Bearing Weight Loss	26 mg, max	1
TEOST MHT-4 (ASTM D7097)		
Deposit Weight	35 mg, max	35
TEOST 33C (ASTM D6335)		
Deposit Weight	30 mg, max	15

SAE 5W-20 GF-5 Reference Oil Candidate

Physical/Chemical Property Requirements	**Specification**	**Results**
Viscosity at 100 °C (ASTM D445), mm^2/s, 5W-20	5.6 - <9.3	8.3
Viscosity at -30 °C (ASTM D5293), mPa.s	6600 max	3500
Low Temp. Pumping Viscosity at -35°C, mPa.s	60,000 max	10,000
Volatility		
Evap. Loss, 1 hr at 250 °C (ASTM D5800), %	15.0 max	14
Dist. by GC at 371 °C (ASTM D6417), %	10.0 max	5
Gelation Index (ASTM D5133)	12.0 max	5
HTHS Viscosity, mPa-sec at 150 °C & 10^6 1/sec (ASTM D4741 or ASTM D4683)	2.6 min	2.6
Filterability with short heating (ASTM D6795), %	50 max	-26
Filterability with long heating (ASTM D6794), %	50 max	-10
Foaming (ASTM D892) (after 1 minute settling time for all foaming sequences)		
Sequence I, mL*	10/0 max	0/0
Sequence II, mL*	50/0 max	0/0
Sequence III, mL*	10/0 max	0/0
High Temperature Foaming (ASTM D6082), mL*	100/0 max	50/0
Phosphorus, (ASTM D4951), % mass	0.06 - 0.08	0.077
Sulfur, (ASTM D4951 or D5453), % mass	0.50 max	0.3
Emulsion Retention,(ASTM D7563)		
0°C, 24 hours	No water separation	Water separation
25°C, 24 hours	No water separation	Water separation
Homogeneity and Miscibility (ASTM D6922)	No Separation	No Separation
Elastomer Compatibility (ASTM D7216 ANNEX A2)		
a. Polyacrylate Rubber (ACM-1)		
Volume (ASTM D471), %Δ	-5, 9	0.51
Hardness (ASTM D2240), pts.	-10, 10	-2
Tensile Strength (D412), %Δ	-40, 40	-12.5
b. Hydrogenated Nitrile Rubber (HNBR-1)		
Volume (ASTM D471), %Δ	-5, 10	-1.79
Hardness (ASTM D2240), pts.	-10, 5	0
Tensile Strength (D412), %Δ	-20,15	10.1
c. Silicone Rubber (VMQ-1)		
Volume (ASTM D471), %Δ	-5, 40	22.98
Hardness (ASTM D2240), pts.	-30,10	-20
Tensile Strength (D412), %Δ	-50, 5	-45.5
d. Fluorocarbon Rubber (FKM-1)		
Volume (ASTM D471), %Δ	-2, 3	-0.52
Hardness (ASTM D2240), pts.	-6, 6	-1
Tensile Strength (D412), %Δ	-65, 10	-12.9
e. Ethylene Acrylic Rubber (AEM-1)		
Volume (ASTM D471), %Δ	-5, 30	14.47
Hardness (ASTM D2240), pts.	-20,10	-7
Tensile Strength (D412), %Δ	-30, 30	-4.4

Potential GF-5 Reference Oil Test Data

Test Method	Parameter	Unit	Limit			Test Result	
						5W-20	5W-30
Sequence VIII - D6709	10 h Stripped Viscosity	cSt	stay in grade			VGRA	9.7
	Total Bearing Weight Loss	mg	26 max.				20
Sequence IIIGB - D7320	Phosphorus Retention	%	79			VGRA	88
Sequence IVA - D6891	Average Cam Wear	µm	90 max.			VGRA	6
Sequence VID - D7589			XW20	XW30	10W30		
	FEI Sum	%	2.6	1.9	1.5 min	2.7	N/A
	FEI2	%	1.2	0.9	0.6 min	1.3	N/A
Sequence IIIG - D7320	Kinematic Viscosity Increase @40 °C	%	150 max.			VGRA	66
	Average Piston Skirt Varnish	merits	report				9.5
	Weighted Piston Deposits	merits	4.0 min				4.4
	Avg. Cam and Lifter Wear	µm	60 max.				24
	Hot Stuck Rings		None				none
	Oil Consumption	Liters	Report				3.5
Sequence VG - D6593	Average Engine Sludge	merits	8.0 min.			VGRA	9.1
	Rocker Cover Sludge	merits	8.3 min.				9.4
	Average Piston Skirt Varnish	merits	7.5 min.				8.1
	Average Engine Varnish	merits	8.9 min.				9.0
	Oil Screen Sludge	%	15 max.				2
	Hot Stuck Compression Rings		none				none
	Cold Stuck Rings		report				1
	Oil Screen Debris	%	report				20
	Oil Ring Clogging	%	report				0
	Average Follower Pin Wear	µm	30 max. (Ford spec)				3.9
	Average Ring Gap Increase	µm	225 max. (Ford spec)				76
Ball Rust Test - D6557	Average Gray Value		100 min.			VGRA	131

Attachment 8

Sequence VG Surveillance Panel
May 13, 2010
9:00AM – 12:00PM
Southwest Research Institute
San Antonio, TX

Motions and Action Items
As Recorded at the Meeting by Raham Kirkwood and Dan Worcester

1. Action Item – Conference call will be held to determine the next fuel prove-out matrix. Statistics sub-group will develop recommendations and report back to the Surveillance Panel.

2. Action Item – Form a task force to develop a recommendation to the surveillance panel for adopting LTMS 2nd Edition to the Sequence VG. Task force to report to surveillance panel before Tuesday July 13th at 2PM EST.

3. Motion – Based on successful results from the chemical analysis of the lab blend the Surveillance Panel instructs Haltermann to create a full tank of VG fuel.

   Ed Altman / Mark Sutherland / Passed 12-0-1

4. Motion – To have Seq. VG procedures Section 11.1.1 wording changed to "15 operationally valid" tests.

   Al lopez / Ed Altman / Tabled for E-Ballot with improved wording

5. Motion – Accept both potential reference oils as GF-5 category reference oils. Consider using either oil for the Sequence VG and replacing one of the outdated reference oils currently in use. Conduct a follow-up surveillance panel conference call to develop a plan for adopting one or both of these potential reference oils.

   Rich Grundza / Mark Sutherland / Passed 12-0-1