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: July 10, 2003
Corrected : July 23, 2003

Reply to: Frank Farber
ASTM Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206
Phone: 412-365-10304
Fax: 412-365-1047
Email: fmf@astmtmc.cmu.edu

Unapproved Minutes of the June 10, 2003 Sequence III Surveillance Panel Meeting held in Detroit, Michigan

The meeting was called to order at 9:00 am by Chairman Bill Nahumck. A membership list was circulated for members & guests to sign in. It's shown in Attachment 1.

Agenda Review

Ben Weber is Action & Motion recorder.
Status of Method progress of IIIF added to agenda.

The Agenda was accepted as attached (Attachment 2).

Membership Changes

No membership changes.

Meeting Minute Status
November 2002 (corrections posted), February 2003 and April 2003 (corrections posted) Approved.

Pre & Post Meeting E-Ballots

In order that email ballots are documented the following post meeting email ballots have been included in the meeting minutes:

Sequence IIIG motion sent by chairman on 6/23/2003: I have received a **motion from Sid Clark**, which I will second, to reinstate Paragraph 13.10.6 in the Sequence IIIG Draft Procedure. At our meeting on Tuesday, June 10, 2003, the panel felt that there was no need to have a validity statement related to oil consumption for the purposes of MTAC and had decided to delete that section in the IIIG test procedure. After further reflection, the Test Sponsor would like to reinstate this section but in a more simple form that is not related to Noack volatility.

I move that the following paragraph be reinstated into the Sequence IIIG Draft test Procedure.

13.10.6 For non-reference oils, the test results are considered non-interpretable for the purposes of MTAC if the oil consumption at end of test exceeds 4.65L.

Please respond to this ballot by the close of business (5 PM Central) on 6-20-03. It is important that you respond to this motion. This is not a motion for unanimous consent where a response is not needed.

Chairman's follow-up on 7~~6~~/2/2003: I have tallied up the motion from Sid Clark and the motion passes with a vote of 9-0-1. The following comment was given by Gordon Farnsworth.

I approve but have reservation on how 4.65L was chosen. I believe this was selected since it was the highest value experienced in the IIIG matrix. Only 5W-20 and 5W-30 oils were in the matrix and I wonder if 0W grades may have directionally higher OC. I also recognize that if OC is above 4.65L the test results are likely to be unrepresentatively severe due to low oil sump level. Thus I agree we start with a 4.65L level for interpretability but revisit later if needed.

Sequence IIIF/IIIG/IIIFHD report form revision motion: Frank Farber has made the following Motion for Unanimous Consent for adding the ACC conformance sheet to the data dictionary for the Sequence III tests. Be sure to read the attachment that is at the end of the sheet.

After discussing with Frank, he intended this to include the IIIFHD test. It should also be noted the ACC conformance sheet will be added as the LAST page so that if the test is a reference test or is not registered with RSI, the form can simply be discarded. I (Bill Nahumck) will second the motion. As Frank noted, if no negative votes are received by Wednesday June 25, 2003 the motion will be considered approved. The implementation date will be 30 days from June 25, 2003.

Sequence IIIG – Sid Clark

See Attachment 3. The 24-test matrix was completed on schedule!
Three tests were lost for oil consumption and subsequently rerun. The first test's high oil consumption was because of a leaking sample valve. The second test's high oil consumption was attributed to a possible error on initial oil level. The third test saw a failure in an exhaust backpressure valve that resulted in scuffing.

Statistical Analysis of Matrix Report – Phil Scinto

Attachment 4 shows the report. There was not enough statistical evidence to include stand within lab or cam/phosphate batch into the final models. Transformations on three parameters were presented and approved by the panel.

Parameter	Transformation
Percent Viscosity Increase	**natural log**
WPD	none
MRV	**inverse square root**
ACLW	**natural log**
APV	none

All means shown on the presentation are calculated using transformations where appropriate and then untransformed into original units.

Lab oil consumption effects were noted.

Percent Viscosity Increase Notes

The Statistical Group found that percent viscosity increase discrimination is improved by adjusting results for oil consumption using the equation
ADJ VISNC= exp((ln(vis))-0.75(OC-3.85)).

Using this adjustment brings the reference oil standard deviations closer together.

Other items noted were:
Oil 434 viscosity increase is most effected by oil consumption.
Oil 435 viscosity increase is effected by oil consumption
Oil 438 viscosity increase is effected the least by oil consumption (see natural log correlation plots for each oil) See slope of best fit line - Viscosity Increase / unit change of oil consumption.

The stated oil consumption adjustment slope of 0.75 is for all oils. Different viscosity grade oils may ~~be~~ exhibit different behavior than described by the adjustment equation. All matrix oils were 5W30 oils.

Because the statistical group did not have enough time, it was suggested that other oil consumption like adjustments for viscosity increase be investigated.

Presentation material note: E_p is the ratio of the standard deviation of the test parameter / the ACC determined acceptable difference between tests.

WPD Notes

Oils are different in Lab A on WPD, but no evidence of this in Lab G.
Oil 434 looks different than the other two oils on WPD.

The four highest results on oil 434 are from lab A.

A new weighting scheme for WPD improves distribution of standard deviation of the three matrix oils. See plot. GM stated that they did not wish to pursue different weighting factors.

Most of the variability of WPD comes from ORLD.

APV Notes

No statistical evidence that labs or oils differ.

ACLW Notes

Oil 438 shows less wear than oils 434 and 435; 18 vs 36 microns. The ACLW transformation yields an acceptable E_P.

Oil Consumption Notes

Statistical evidence exists that labs differ and that there is a stand effect.

MRV Notes

There was weak evidence of stand effect which is somewhat related to the weak stand effect of oil consumption. Time effect of MRV data has not been looked at close but it appears that there is no effect. Oil 435 was removed from analysis because of the high MRV values.

~~30 maximum difference on allowable visc. Increase.~~

~~E_P ratios below one are unacceptable.~~

~~APV ACC 0.3 maximum difference~~

~~ACLW ACC D_P =10~~

~~ACLW transformations yields E_P acceptable.~~

The Statistical Group was requested to investigate MRV vs oil consumption, MRV vs oil level and oil level vs Viscosity in more detail.

Action item: Post a database of oil levels at 20 periods for the matrix data.

Discussion of APV Round Robin – Michael Kasmirsky

Michael presented Attachment 5. Lab M and F raters indicate that a workshop is needed.

The surveillance panel requested that the TMC schedule a Sequence IIIG rating workshop by the end of June, prior to candidate test registration based on the round robin APV study. The workshop is to utilize a subset of matrix pistons. Motion made by Dwight Bowden seconded by Sid Clark. Passed unanimously.

Quality Index Review-Michael Kasimirsky

Michael recommended that the Sequence IIIF ranges be implemented for the Sequence IIIG. Ranges will be moved to the Sequence IIIG set points where appropriate. The motion was made by Sid Clark and seconded by Gordon Farnsworth and passed unanimously. TMC was instructed to issue a memo.

Report Form Changes

Charlie Leverett requested that Total Oil Consumed be added to Sequence IIIG Form 5. Sequence IIIF hardware report form should be modified for connecting rod type info.

Sid Clark will issue Draft 3 of the test procedure as soon as possible.

MRV & CCS Issues

Sid and panel will review MRV & CCS measurement protocol for the next draft. A motion was made by Pat Lang and seconded by Charlie Leverett to adopt the IIIF MRV requirements for the IIIG, i.e. if Percent Viscosity Increase is above 500%, no MRV/CCS measurement is required.

LTMS Presentation 1 - Ben Weber

Ben presented Attachment 6 on behalf of ACC & the Independent Labs.

LTMS Presentation 2 – Frank Farber

Frank Farber presented two items (Attachment 7) that the TMC felt the panel needed to consider before voting on the LTMS revisions. The first point was that the TMC has observed problem stands in the Sequence IIIF and that there will be problem stands in the Sequence IIIG. The TMC felt that the premise that was made in the prior presentation that indicated laboratory factors were the only issues that needed frequent monitoring was susceptible to allowing stand problems to exist for possibly a year when labs are not exceeding the run limits. The TMC also indicated that labs with greater than 2 stands using the proposed referencing requirements would run 50% less reference tests than the current system when running up against the 100 day time limit. Labs with greater than two stands would run even less references. When labs are running flat out and hitting the run number limit the new proposal would reduce referencing at the two or more stand labs by ~ 30 – 40 %. Given the importance of the severity adjustment system and its dependency on timely data and the lack of familiarity with the IIIG the TMC felt the previous proposal was not in the industries best interest.

The seconded item that the TMC was concerned with was that during times where the lab run counter was not a factor, precision problems could exist 400 days with the 4–test block precision monitoring proposal before another test was run. The TMC felt a method that checked laboratory precision every test was a better approach.

After the TMC proposal presentation, Charlie Leverett/ Pat Lang motioned that the ACC and independent lab's proposal be accepted. Sid Clark requested that the motion be

tabled until after lunch for further discussion. No action was taken on Sid's request. The motion passed with 6 for, 1 against (test sponsor) and 5 abstain. The motion passed.

Drain Oil Processing

Chairman Bill Nahumck presented Chris May's IIIG drain oil MRV study (Attachment 8). D 4684 reproducibility for fresh oils (no yield stress) @ -30 °C is 18.4% (~9200 for a 50,000 cP oil). This factor should be considered when limits for the test are discussed. They have not observed consistent trends in viscosity change with time.

Michael Kasmirisky motioned that the start/preparation of IIIIG MRV measurement is to start within 168 hours (1 week) of test completion similar to the current IIIF procedure. The motion was approved.

LTMS Discussion Continued

GM would like to have every test utilize a 4-test standard deviation calculation for lab precision instead of the 4-test block approach that was accepted previously with a review in one years time. Sid Clark made the motion and Dwight Bowden seconded. Motion : 5 passes, 0 against, 5 waives.

Additional LTMS Issues

The panel approved that there will be no stuck rings on reference tests.

Michael Kasimirsky motioned to drop any LTMS parameter that is no longer a pass/fail parameter. In addition, the MSE values stated by the statistical task force should be used to calculate severity adjustments. Charlie Leverett seconded. Approved 10 fors, 0 opposed, 0 waives

Gordon motioned, MTK seconded 1/3 usage for 434, 435 and 438. The motion was amended so that the first test on stand is 438 and the second test is either 434 or 435. Current referencing has been run under this rule. 9 passes, 1 oppose ,2 waives.

Targets are updated @ 10, 20 and 30. Freeze at 30 tests. (Gordon Farnsworth /Dwight Bowden) The motion was approved.

Charlie Leverett motioned, Pat Lang seconded, to eliminate the blowby specification for first 26 hours (Section 13.14.3). The motion passed.

Recommendation to PCEOCP

Sid Clark motioned that the Sequence IIIG test be considered for inclusion into the GF-4 category based upon precision matrix data. Hanna Murray seconded. 9 for, 0 against, 2 waive.

Gordon recommended that an objective be added to the Scope and Objectives list for improving the IIIG test be made and noted to the class panel:

The surveillance panel also decided to request the Precision Matrix Data Analysis Group to continue/ evaluate the precision matrix data for correlations of:

- Continue data analysis on WPD and Oil Consumption, including on trying to understand lab differences on these two parameters.
- Investigate correlation between Oil Consumption and other test parameters.
- Differences in rates of oil consumption over time.
- Correlation between blowby and test parameters.
- Correlation between MRV & Viscosity Increase.
- Correlation between NO_x and deposits.
- Initial oil level.
- Different weighting factors for WPD.

O&H Issues-Pat Lang

Review of Oil Filter Email Motion: Sequence IIIF oil filter motion sent by chairman on May 27, 2003: OHT has notified the industry that they are depleted of PF-47 batched oil filters for the Sequence IIIF kits. They will be unable to ship IIIF kits out of their inventory. As of today, neither matrix laboratory has experienced any bypass events with the new Pro-Tec oil filters with the IIIG testing. There~~ir~~ have been no reported bypass problems at any other laboratory that is running the IIIG tests, either for customers or LTMS. We need to implement this ASAP to insure no interruption of Sequence IIIF testing.

Therefore, I make a motion for unanimous consent that the substitution of the new Pro-Tec oil filter, Part# OHT3G-057-3, be allowed as an acceptable replacement for the batch coded PF-47 oil filters, Part# OHT3F-057-1, for Sequence IIIF testing, with an effective use date of 1700 hours ET, May 30, 2003. The motion has been seconded by Jason Bowden. If I do not hear any objections or negatives to this motion by 1200 hours ET on May 30, 2003, this motion will be considered approved.

Chairman's follow-up on 6/2/2003: As I have received no objections or negative comments, the motion for unanimous consent is considered passed in the affirmative. The TMC will issue an information letter, likely after the June 10, 2003 meeting, in case there are any other items for an information letter. The use of the Pro-Tec oil filters for IIIF testing is allowed as of 17:00 hours ET, May 30, 2003

The panel adopted the front cover (OHT3G-085-1) and oil housing (OHT3G-080-1) for the IIIF and IIIG testing. OHT will rework any new front cover that the labs might have in their inventory. Effective by June 30,2003.

IIIF dipstick has been modified (longer) for IIIG. To avoid confusion and potential mistakes, all IIIF dipsticks will be replaced with the new IIIG dipsticks effective by June 30, 2003

Mass air flow sensor part numbers:

Original 2-bolt p/n 24508238
24508238 superseded with 12568877
1256877 superseded by p/n 88961007 (remanufactured)
No remanufactured units in the field until later this year

The assembly manual will be modified by Sid Clark and sent to the TMC for distribution.

Solvent Survey:

IIIG Procedure states: Solvent is Type 2 Class A

IIIF solvent was also incorrect and will be changed to:

A motion was made by Charlie Leverett, seconded by Dwight Bowden, to require Type 2 Class C Solvent for both IIIF and IIIG tests by 12/31/2003. Motioned passed with one waive.

Parts Cleaning with Jet Washer Issue:

Prior to the start of the matrix, both matrix labs changed bath soap/water. No new soap was added after the initial mixing of bath.
NAT-50 soap used @ SWRI and PE. Neither lab used a rinse cycle.

Some labs are using PDN-50 soap. Pat will continue to work on eliminating differences on this item.

<u>CPD Reports</u>

CPD Report is Attachment 10.

GM Motorsports Report is shown in Attachment 11.

The oil consumption worksheet needs to be corrected by test sponsor.

Chairman Notes

The Sequence IIIF Standard test method is scheduled for next ballot.

Scope & Objectives

The chairman presented the most recent Scope and Objectives as shown in Attachment 12.

Objective 1 target date was changed to November 2003

Objective 6 was added to Continue IIIG Precision Matrix Analysis.

The Sequence IIIG Research Report is being worked on by Sid Clark.

It was stated that there has been no request or desire by panel to correlate the IIIG with the IIIF.

OHT supplied calibrated beakers used for measuring the initial crankcase oil charge are mandatory for IIIF/IIIG effective no later than June 30, 2003. Motioned by Charlie Leverett , seconded by Gordon Farnsworth. Motioned passed. (9 approve, 0 oppose,1 waive).

Meeting adjourned at 5:18 pm.

Motions & Action Items
Sequence III Surveillance Panel
June 10, 2003
As Recorded at the Meeting by Ben Weber

1. Action Item - Sid will put together a database of the 20-h oil levels to better understand oil consumption and the need for a correction. The matrix design task force will analyze this data. This is more of a long-range plan to help understand the oil consumption for the IIIG.
2. Motion by Dwight and seconded by Sid that we need to have a rating workshop as soon as possible, preferably before the end of June. We should use some of the matrix pistons that have been dual rated and haven't been shipped away yet. Motion passed unanimously.
3. Motion by Sid and seconded by Gordon that the Surveillance Panel adopt the use of the QI limits proposed by Mike K at this meeting.

4. The IIIG will adopt the same methodology used in the Sequence IIIF regarding whether to even run a CCS/MRV based on high EOT viscosity values.
5. The MRV must be started within 168 hours of EOT. We will continue to up-end the samples as was done during the matrix. Passed unanimously.
6. Sid motioned and Dwight seconded that the LTMS precision is reviewed every test using a rolling average of the last 4 tests, with a review of the new LTMS methodology within one year. Motion passed, but with more waives than positive or negative votes.
7. Mike K motioned and Charlie L seconded to adopt the parameters (PVIS, WPD, ACLW, APV, MRV) with their appropriate transformations, means and standard deviations as reported in the statistical matrix report. Motion passed unanimously.
8. Gordon motioned and TMC seconded that the oils will be assigned equally, with 438 as one of the first oils for a new lab along with either 434 or 435 to complete the required two oils for a new lab. Motion passed on a 9-1-2 vote.
9. Gordon motioned and seconded by Dwight that the targets will be updated on a 10, 20 and 30 count basis. Motion passed unanimously.
10. TMC will review the blow-by data for the first 26 hours of the IIIG matrix for establishing a minimum limit.
11. No stuck rings were added to the acceptance of valid calibration tests.
12. Motion by Charlie and seconded by Pat L to delete section 13.14.3 from the IIIG test method. Passed unanimously.
13. Motion by X and seconded by X to delete sections 13.10, 6.1 & 6.2 from the IIIG test method. Passed unanimously.
14. Sid motioned and seconded by Hannah Murray that the Sequence IIIG be considered for inclusion into the GF-4 specification based on the precision matrix data. The motion passed by a vote of 9-0-2.
15. Gordon motioned that a list of items be put together that need to be worked on for improving the IIIG. What are the concerns for the IIIG from this panel?
    - OC impact on all other variables
    - Difference between labs on WPD and oil consumption
    - Oil levels versus time
    - Does blow-by impact WPD, OC, PVIS, MRV?
    - PVIS and MRV correlation – this one is already done
    - NOx versus WPD
    - Initial oil level variability
    - Weighting factors for WPD – decided later that these will not be changing
    - OC versus any other thing you can think of

When should this be done? We are hoping to have this completed by the end of June.

16. Charlie motioned and seconded by Sid that we adopt the front cover (OHT3G-085-1) and oil filter housings (OHT3G-080-1) for sequence IIIF testing effective June 30th. Passed unanimously.
17. Charlie motioned and seconded by Sid that we replace the IIIF dipstick with the new IIIG dipstick for both the IIIF and IIIG testing effective June 30th. Passed unanimously.
18. Action Item - Pat and Charlie will finalize the cleaning process for inclusion into the test method.

ATTACHMENT 1

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Ed Altman Ethyl Petroleum Additives, Inc. P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5279 804-788-6358 ed_altman@ethyl.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Beto Araiza Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249 USA	210-877-0222 210-690-1959 baraiza@tei-net.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Monica Beyer The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2006 440-347-4096 mbey@lubrizol.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	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	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Donald Bryant The Lubrizol Corporation 28400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2159 440-943-9004 debr@lubrizol.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Don Burnett ChevronPhillips Chemical Compan Chevron Tower 1301 McKinney Street Suite 2130 Houston, TX 77010-3030 USA	713-289-4859 713-289-4865 burnede@cpchem.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
James Carter Haltermann Products 3520 Okemos Rd. Suite #6-176 Okemos, MI USA	517-347-3021 517-347-1024 JECarter@dow.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present JRC
Timothy L. Caudill Ashland Oil Inc. 22nd & Front Streets Ashland, KY 41101 USA	606-329-5708 606-329-3009 tlcaudill@ashland.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Sid Clark GM Powertrain General Motors Corporation Mail Code 480-106-160 30500 Mound Rd. Warren, MI 48090-9055 USA	586-986-1929 586-986-2094 sidney.l.clark@gm.com Test Sponsor Rep	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present Sid
Frank Farber ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1030 412-365-1047 fmf@astmtmc.cmu.edu	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present Frank Farber

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Gordon R. Farnsworth Infineum P.O. Box 735 Linden, NJ 07036 USA	908-474-3351 908-474-3637 gordon.farnsworth@infineum.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present GRF
Frank Fernandez ChevronOronite Co., LLC 4502 Centerview Drive Suite 210 San Antonio, TX 78228 USA	210-731-5603 210-731-5699 ffer@chevron.con PCEOCP Chair	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present FF
Dennis Florkowski DaimlerChrysler 800 Chrysler Road CIMS 482-00-13 Auburn Hills, MI 48236-2757 USA	248-576-7477 248-576-7490 df11@daimlerchrysler.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Thomas M. Franklin PerkinElmer Automotive Research, 5404 Bandera Road San Antonio, TX 78238 USA	210-647-9446 210-523-4607 tom.franklin@perkinelmer.com Sub-Committee D02.B Chair	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
David L. Glaenzer Ethyl Petroleum Additives, Inc. 500 Spring Street P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5214 804-788-6358 dave_glaenzer@ethyl.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Irwin L. Goldblatt Castrol Americas 240 Centennial Avenue Piscataway, NJ 08854-3910 USA	732-980-3606 973-686-4224 irwin.goldblatt@cnacm.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Larry Hamilton The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2326 440-347-4096 ldha@lubrizol.com	☐ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present Larry Hamilton
Michael T. Kasimirsky ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1033 412-365-1047 mtk@astmtmc.cmu.cdu	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present Michael Kasimirsky
Brian Kundinger Kundinger Controls 1771 Harmon Road Auburn Hills, MI 48326 USA	248-391-6100 248-391-6900 bkundinger@kundnger.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Patrick Lai Imperial Oil Limited 453 Christina Street Research Department P.O. Box 3022 Sarnia, Ontario N7T7MI CANADA	519-339-5611 519-339-5866 patrick.k.lai@esso.ca	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Patrick Lang Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-2820 210-684-7523 plang@swri.edu O&H Subpanel Chairman	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present Pat Lang
Charlie Leverett PerkinElmer Automotive Research, 5404 Bandera Road San Antonio, TX 78238 USA	210-647-9422 210-523-4607 charlie.leverett@perkinelmer.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Vince Livoti Ciba Specialty Chemicals 540 White Plains Road P.O. Box 2005 Tarrytown, NY 10591-9005 USA	914-785-4494 914-785-4249 vincent.livoti@cibasc.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Josephine G. Martinez Chevron Oronite Company LLC 100 Chevron Way Richmond, CA 94802 USA	510-242-5563 510-242-1930 jogm@chevrontexaco.com	☐ IIIF SURV PANEL ☐ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Mike McMillan GM R&D Center MC480-106-160 Chemical & Environmental Science 12 Mile & Mound Roads Warren, MI 48090-9057 USA	586-986-1935 586-986-2094 micheal.l.mcmillan@gm.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present MLM

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
John Moffa Castrol International Technology Centre Whitchurch Reading, RG8 7QR ENGLAND	00441189765263 00441189841131 John_Moffa@burmahcastrol.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Alfredo Montez Chevron Oronite 4502 Centerview Drive #210 San Antonio, TX 78228 USA	210-731-5604 210-731-5694 AMMN@chevron.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present by F. Fam
Mark Mosher ExxonMobil Technology Company Billingsport Road Paulsboro, NJ 08066 USA	856-224-2132 856-224-3628 mark.r.mosher@exxonmobil.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Hannah Murray Toyota Technical Center, USA, Inc. 1588 Woodridge RR #7 Ann Arbor, MI 48105 USA	734-995-3762 734-995-5971 hmurray@ttc-usa.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
William M. Nahumck The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2596 440-347-4096 wmn@lubrizol.com Surveillance Panel Chair	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
James L. Newcombe Pennzoil-Quaker State Company 34388 Quaker Valley Road Farmington Hills, MI 48331 USA	248-888-8301 248-888-8302 James.Newcombe@associates.PZLQS.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
Rick Oliver Registration Services Inc. 2805 Beverly Drive Flower Mound, TX 75022 USA	972-724-2136 210-341-4038 crickoliver@attbi.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present
Robert Olree GM Powertrain 30500 Mound Road m/c 480-106-160 Warren, MI 48090-9055 USA	810-947-0069 810-986-2094 robert.olree@gm.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☑ O&H Mailing List	Present
Michael J. Riley Ford Motor Company 21500 Oakwood Blvd. POEE Building, MD44 Cube DN-159 Dearborn, MI 48121-2053 USA	313-390-3059 313-845-3169 mriley2@ford.com	☑ IIIF SURV PANEL ☐ IIIF MAILING LIST ☑ O&H SUBPANEL ☐ O&H Mailing List	Present
Robert H. Rumford Specified Fuels & Chemicals, LLC 1201South Sheldon Road Channelview, TX 77530-0429 USA	281-457-2768 281-457-1469 rhrumford@specified1.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present

ASTM SEQUENCE IIIF LIST

June 10, 2003 Romulus, Michigan

NAME / ADDRESS	PHONE / FAX / E-MAIL		SIGNATURE
Philip R. Scinto The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2161 440-347-9031 prs@lubrizol.com	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	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	☐ IIIF SURV PANEL ☑ IIIF MAILING LIST ☐ O&H SUBPANEL ☐ O&H Mailing List	Present

SEQUENCE IIIF SURVEILLANCE PANEL MEETING A1-9
GUEST LIST
June 10, 2003
Romulus, Michigan

NAME/ADDRESS	PHONE/FAX/EMAIL	SIGNATURE
Doug Deckman - ExxonMobil 600 Billingsport Rd Paulsboro, NJ 08062	856-224-2658 " " -3613 DougeDeckman@ ExxonMobil.com	
Lowell Norris ExxonMobil 17402 Moreton LN Spring TX 77379	lowell.t.norris@exxonmobil.com	Lowell
Dan Pridemore Ethyl 2000 Town Center Dr. #1750 Southfield, MI 48075	ph: 248-350-0640 Dan_Pridemore @Ethyl.com	
Jason Bowden OH Technologies Inc. P.O. Box 5039 Mentor, OH 44061-5039	P: 440-354-7007 F: 440-354-7080 jhbowden@ohtech.com	
CLIFF VENIER SHELL GLOBAL SOLUTIONS 3333 HWY 6 SOUTH, L103B HOUSTON, TX 77082	281-544-8626 (FONE) 281-544-8150 (FAX) CLIFF.VENIER@SHELL.COM MAILING LIST	
Bob Olree GM Powertrain M/C 480-106-160 30500 Mound Rd Warren, MI 48090-9055	586-947-0069 586-986-2094	
Mike Millian		

A1-10

SEQUENCE IIIF SURVEILLANCE PANEL MEETING
GUEST LIST
June 10, 2003
Romulus, Michigan

NAME/ADDRESS	PHONE/FAX/EMAIL	SIGNATURE
John Glazer		
Steve Herzog		
Rich Lee		

ATTACHMENT 2

AGENDA
SEQUENCE IIIF SURVEILLANCE PANEL MEETING

Marriott Hotel, Romulus, MI
June 10, 2003
9:00 AM to 5:00 PM

1. APPOINTMENT OF RECORDER OF ACTIONS/MOTIONS
2. AGENDA REVIEW
3. MEMBERSHIP CHANGES
4. Approval of Minutes from the November 2002, February 2003 and April 2003 meetings.

*****Focus to be on Sequence IIIG and the IIIG Precision Matrix*****

SEQUENCE IIIG

1. SEQUENCE IIIG DEVELOPMENT UPDATE
   - A. Developer's Report of the Status of the IIIG test – Sid Clark
   - B. Issues Encountered with the Precision Matrix
   - C. Statistical analysis of the IIIG Precision Matrix – Phil Scinto
   - D. Discussion of APV Round Robin – Mike Kasimirsky
   - E. Quality Index Review - Mike Kasimirsky
   - F. "IIIG LTMS - A New Methodology" – Ben Weber/Frank Farber
   - G. Report Form Changes
   - H. Drain oil processing to Chris May/LOTRU – Bill Nahumck
     - i. Initial observations
     - ii. Scheduling Concerns
   - I. Recommendation to the PCEOCP

O&H ISSUES

1. Sequence IIIF Parts
   - A. Review of Oil Filter Motion
   - B. Use of impregnated front covers and oil filter adapters for IIIF
   - C. Use of IIIG dipstick for IIIF
   - D. MAF sensor part number change
2. Cleaning Procedure Review – Pat Lang
3. Solvent Survey – Pat Lang
4. CPD Supplier Reports – IIIF & IIIG
   - A. OHT
   - B. GM MOTORSPORTS

OLD BUSINESS

1. IIIF STANDARD PROGRESS

NEW BUSINESS

1.

ADJOURNMENT

Status of the Sequence IIIG

Presented to the Sequence IIIF / IIIG Surveillance Panel

Sid Clark

June 10, 2003

GM

ATTACHMENT 3

Development Recap

April 17, 2003

The IIIG Development Team reported to the Surveillance Panel membership that the test was ready for Matrix testing.

Development Update

June 10, 2003

The IIIG Development Team is happy to report to the Surveillance Panel membership that the IIIG Precision Matrix testing has been completed on schedule.

GM

Statistical Summary of the Sequence IIIG Matrix

Jo Martinez, Chevron Oronite

Elisa Santos, Infineum

Phil Scinto, Lubrizol

June 6th, 2003

Attachment 4

Outline

- Sequence IIIG Matrix Summary
- Matrix Design
- The data
- Correlations among parameters
- Statistical Analysis of the matrix data by parameter
- Summary of Means and Standard Deviations by Oil
- Appendix
  - Transformation Plots and Run Order Effect Plots
  - Plots of the data for each parameter by Lab and by Stand
  - Summary of unusual observations by parameter
  - Correlation of MRV and PVIS:
    - Used Oil MRV over Fresh Oil MRV versus PVIS
    - Used Oil MRV over Fresh Oil MRV versus PVIS by Oil
  - A Detailed Look at APV Correlations

Sequence IIIG Matrix Summary

- Matrix included 24 operationally valid tests
  - Three other tests were invalid due to high oil consumption
- Model factors considered for all analysis include
  - Lab (A,G),
  - Stand within Lab,
  - Oil (434, 435, 438)
  - Cam/Phosphate Batch (30203, 30422)
- Final model fits for all parameters include Lab and Oil
  - There was not enough Statistical Evidence to Include Stand within Lab or Cam/Phosphate Batch in the final models

Sequence IIIG Matrix Summary

- Parameters of study include
    - Percent Viscosity Increase (VIS),
    - Adjusted Percent Viscosity Increase (NVIS),
    - Average Camshaft plus Lifter Wear (ACLW),
    - Average Piston Varnish (APV),
    - Weighted Piston Deposits (WPD),
    - New Weighted Piston Deposits (NWPD),
    - Oil Consumption (OC),
    - Cold Crank Simulator Viscosity (CCS),
    - MRV Viscosity (MRV)

Sequence IIIG Matrix Summary

- Transformations to stabilize the variance
  - Natural Log Transformations indicated by Box-Cox Analysis for VIS (but not NVIS) and ACLW;
  - Inverse Square Root Transformation indicated for MRV
- There is a general high correlation among VIS, OC and MRV
- There are Lab effects in OC
- There is also an indication of a Lab effect in VIS and MRV.
- There is a Lab by Oil Interaction for Weighted Deposits

Sequence IIIG Matrix Summary

- Ep is Below the ACC Precision Target for Percent Viscosity Increase, WPD, NWPD (but closer), and CCS
- Ep is Above the ACC Precision Target for Adjusted Percent Viscosity Increase and ACLW
- Ep is just at the ACC Precision Target for APV and MRV (Depends)

Sequence IIIG Matrix

- 24 runs, 2 labs, 6 stands, 4 tests/stand
- Degrees of Freedom (Nested model)
  - Oil 2
  - Lab 1
  - Lab(Stand) 4
  - Cam batch 1
  - Mean 1
  - Error 15
- Variance Inflation Factor
  - Lab 3.00
  - Lab1(Stand2) 1.72
  - Lab1(Stand3) 1.72
  - Lab2(Stand2) 1.72
  - Lab2(Stand3 1.72
  - Oil2 1.42
  - Oil3 1.42
  - Cam Batch 1.00

Run	Laboratory	Stand	Oil	Cam Batch
1	SWRI	1	1	1
2	SWRI	1	2	1
3	SWRI	1	3	2
4	SWRI	1	1	2
5	SWRI	2	1	2
6	SWRI	2	2	1
7	SWRI	2	3	1
8	SWRI	2	2	2
9	SWRI	3	1	1
10	SWRI	3	2	2
11	SWRI	3	3	2
12	SWRI	3	3	1
13	PE	1	1	2
14	PE	1	2	2
15	PE	1	3	1
16	PE	1	1	1
17	PE	2	1	1
18	PE	2	2	2
19	PE	2	3	2
20	PE	2	2	1
21	PE	3	1	2
22	PE	3	2	1
23	PE	3	3	1
24	PE	3	3	2

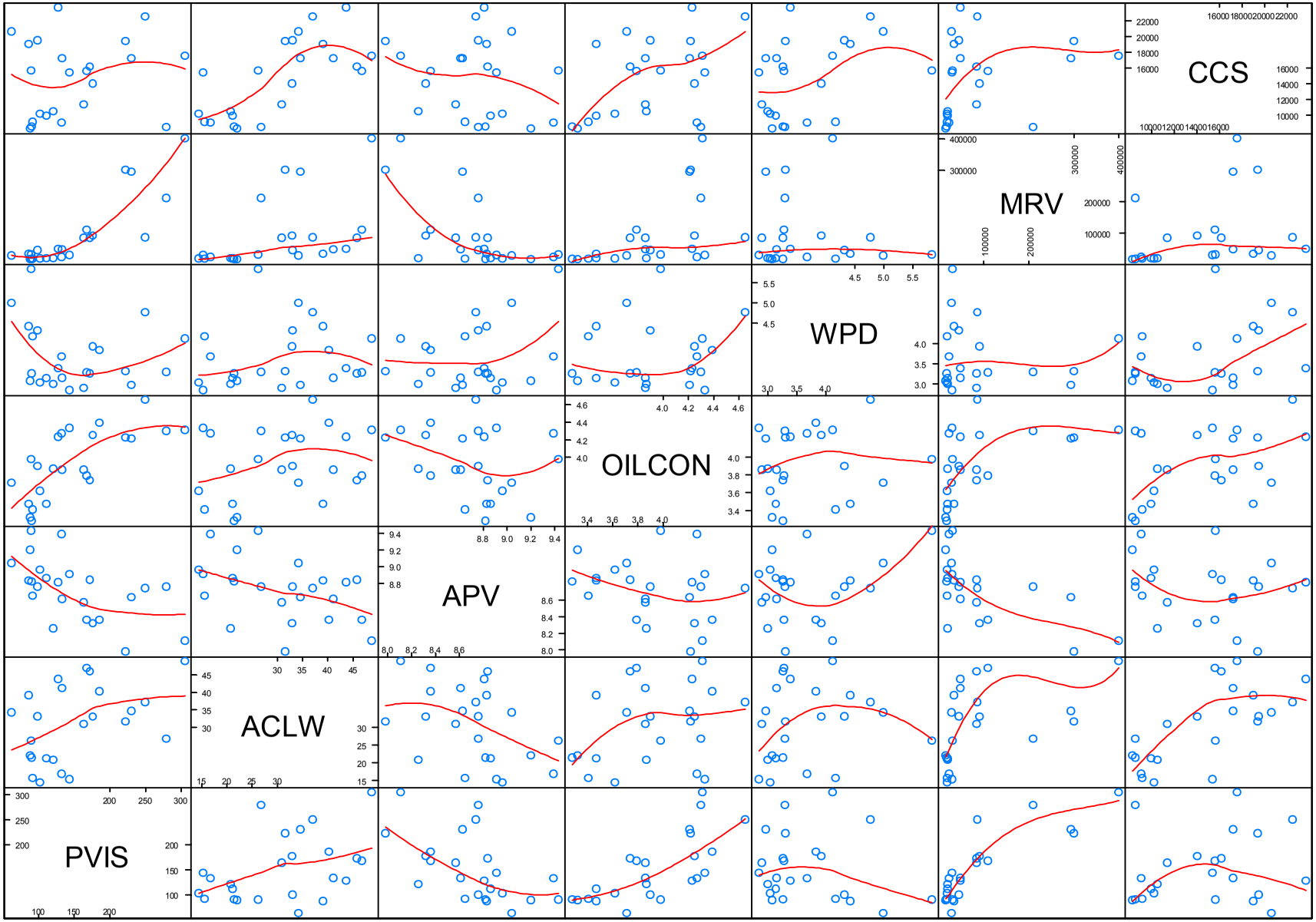
TESTKEY	OIL	LAB	STAND	CAMBATCH	SAEVISC	PVIS	ACLW	APV	WPD	OILCON	CCS	MRV
47905	435	G	3	NF	5W20	163.4	30.9	8.57	2.9	3.86	11370	84800
47888	435	A	3	NF	5W20	172.2	45.8	8.84	3.26	3.74	16160	84500
47893	438	A	1	NF	5W20	102.3	14.4	8.96	3.04	3.62	10200	19300
47901	434	G	5	NJ	5W30	133.3	41.1	8.61	3.15	3.86	17200	48900
47884	434	A	2	NJ	5W30	89.9	26.2	9.43	5.83	3.98	15640	31900
47910	438	G	2	NF	5W20	132.6	16.8	9.39	3.68	4.27	9080	23700
47900	434	G	3	NF	5W30	127.6	43.7	8.81	3.39	4.23	23640	49200
47894	438	A	3	NJ	5W20	111.7	21.2	8.86	3.14	3.47	9920	20500
47906	435	G	5	NJ	5W20	279	26.8	8.76	3.3	4.3	8530	210700
47889	435	A	1	NF	5W20	222.2	31.6	7.98	3.31	4.22	19370	300200
47911	438	G	2	NJ	5W20	143.2	15.3	8.91	2.85	4.33	15400	30400
47902	434	G	3	NJ	5W30	99.2	33.1	8.76	4.32	3.9	19480	45600
47886	434	A	2	NF	5W30	249.5	37.1	8.74	4.77	4.65	22500	86400
47891	435	A	3	NJ	5W20	176.4	33	8.32	3.92	4.25	14040	91900
47913	438	G	3	NJ	5W20	91.7	15.6	8.65	4.17	3.41	9180	19000
47908	435	G	2	NJ	5W20	304.8	48.7	8.11	4.12	4.31	17540	400000
47883	434	A	1	NJ	5W30	86.7	39.1	8.83	4.42	3.47	19000	34200
47907	435	G	5	NF	5W20	230.2	34.6	8.63	2.97	4.21	17200	294000
47895	438	A	2	NF	5W20	88.6	22	9.2	3.08	3.32	8320	16700
47885	434	A	3	NF	5W30	62.8	34.2	9.04	4.99	3.71	20600	29000
47896	438	A	1	NJ	5W20	90.5	21.4	8.82	3.26	3.28	8550	18000
47914	438	G	5	NF	5W20	120.6	20.8	8.26	3	3.87	10530	20500
47890	435	A	2	NJ	5W20	167.7	46.8	8.36	3.28	3.79	15600	110100
48605	434	G	2	NF	5W30	185.7	40.2	8.36	3.83	4.39		

Sequence IIIG Correlations

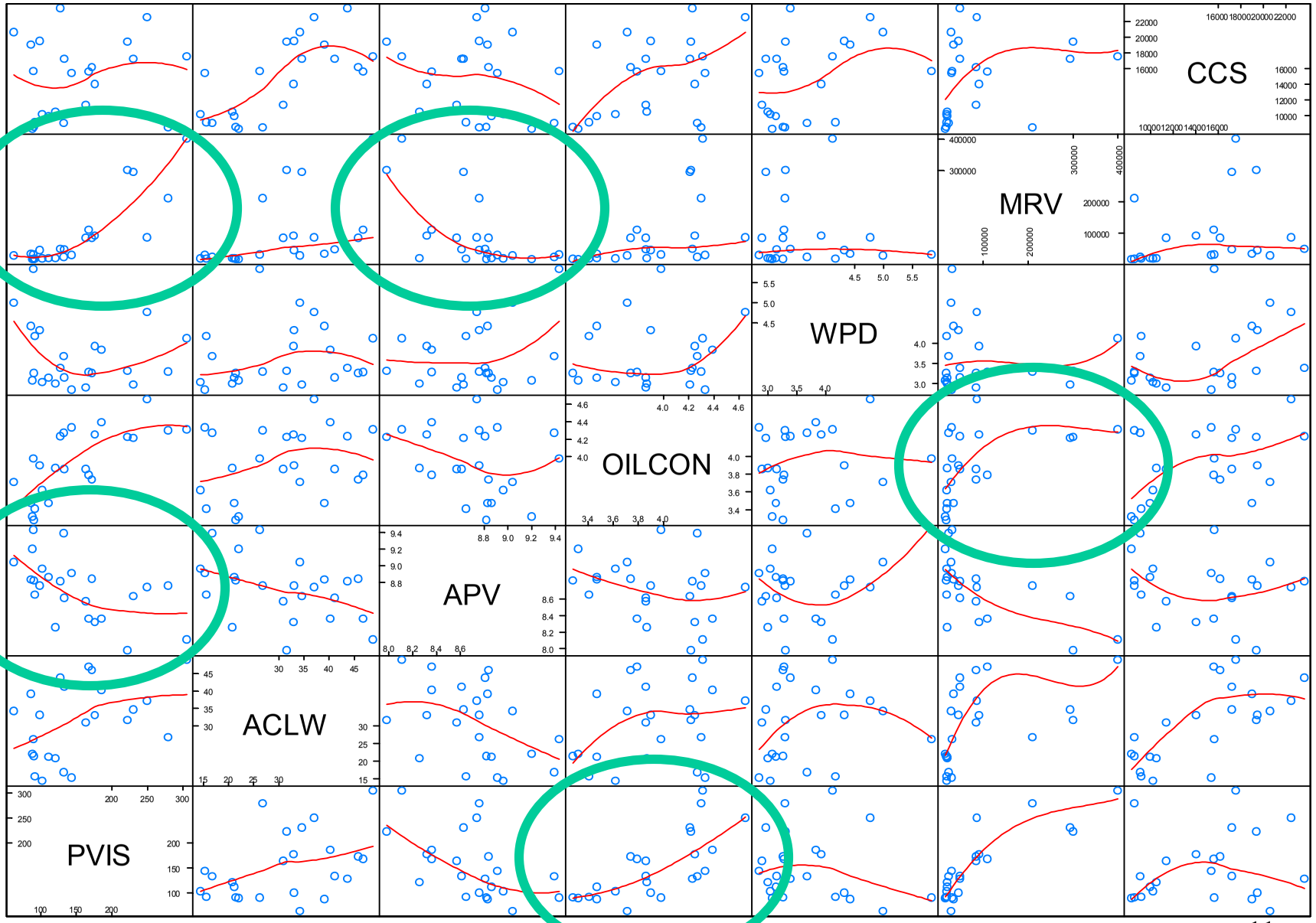
Vis*	0.75	0.40	-0.58	-0.25	-0.27	0.74	0.16	**0.84**
0.50	NVIS	0.34	-0.55	-0.42	-0.41	0.12	-0.16	-0.64
0.10	0.48	ACLW*	-0.42	0.21	0.23	0.30	0.70	-0.71
-0.20	-0.24	-0.34	APV	0.28	0.32	-0.28	-0.20	0.57
-0.05	-0.20	-0.36	0.18	WPD	0.99	0.12	0.40	0.01
-0.10	-0.20	-0.36	0.26	0.99	NWPD	0.09	0.40	0.00
0.76	-0.16	-0.24	0.01	0.17	0.13	OC	0.45	-0.66
0.33	-0.06	0.31	-0.41	-0.18	-0.26	0.42	CCS	-0.49
-0.88	-0.37	-0.03	0.29	0.06	0.13	-0.74	-0.58	MRV*

Raw Data Correlations on Upper Triangle; Partial Correlations on Lower Triangle

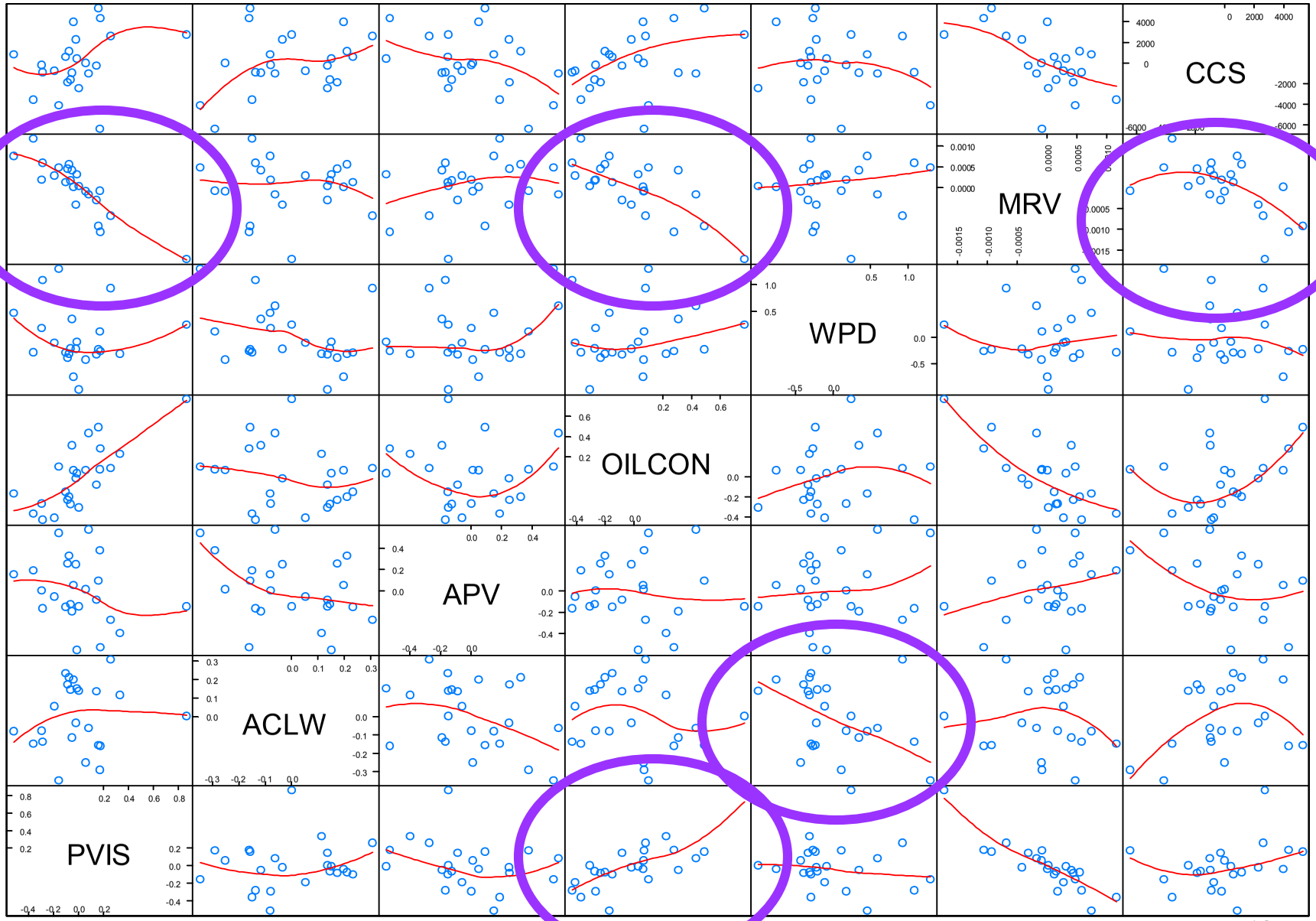
Scatter Plot Matrix of Raw Data with Loess Smoother



Scatter Plot Matrix of Raw Data with Loess Smoother



Scatter Plot Matrix of Residuals with Loess Smoother



Percent Viscosity Increase (VIS)

- Analyzed on Natural Log Scale
- Root Mean Squared Error=0.291911 (20 df)
- Some Statistical Evidence that the Labs Differ
- Strong Statistical Evidence that the Oils Differ

Percent Viscosity Increase (VIS)

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.003	0.828	118.26	95.36 to 146.67
Oil 435	0.003		0.001	208.86	168.40 to 259.03
Oil 438	0.828	0.001		108.52	87.50 to 134.59

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.063		123.56	103.64 to 147.30
Lab G	0.063			156.17	131.00 to 186.18

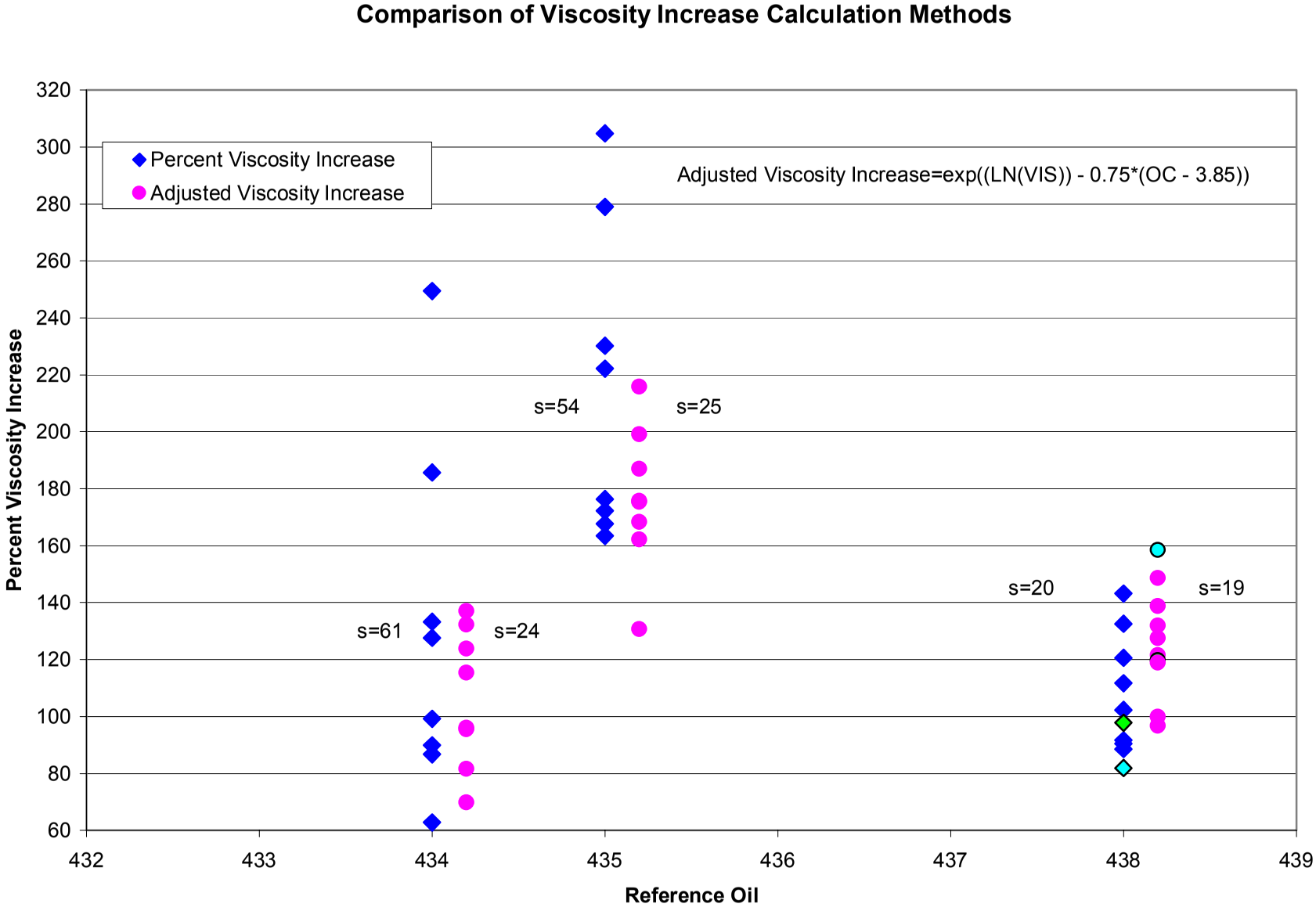
Adjusted Viscosity Increase (NVIS)

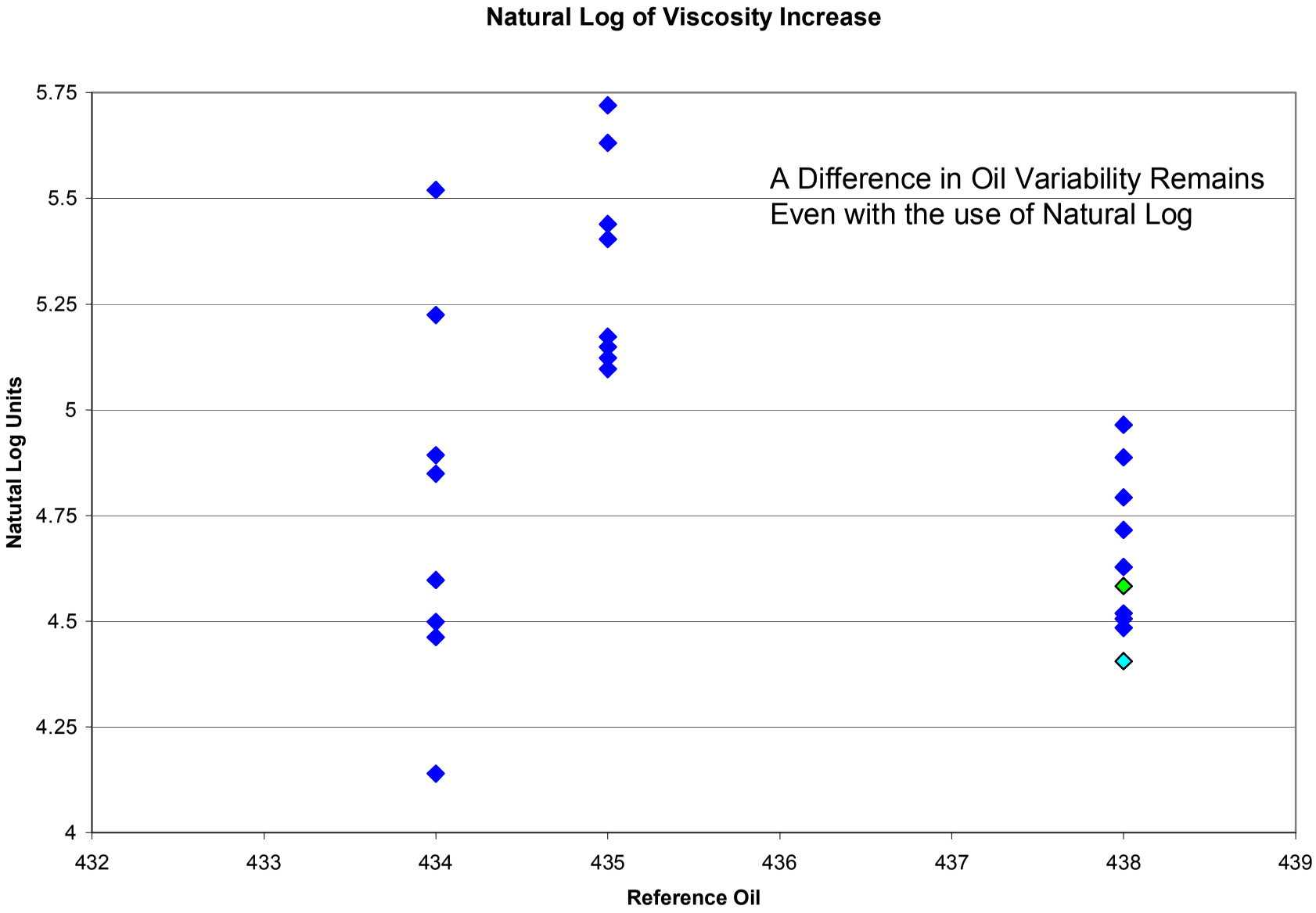
- Test Results Adjusted for Oil Consumption
- Root Mean Squared Error=23.34226 (20 df)
- Marked Improvement in Test Precision
- No Statistical Evidence that the Labs Differ
- Strong Statistical Evidence that the Oils Differ

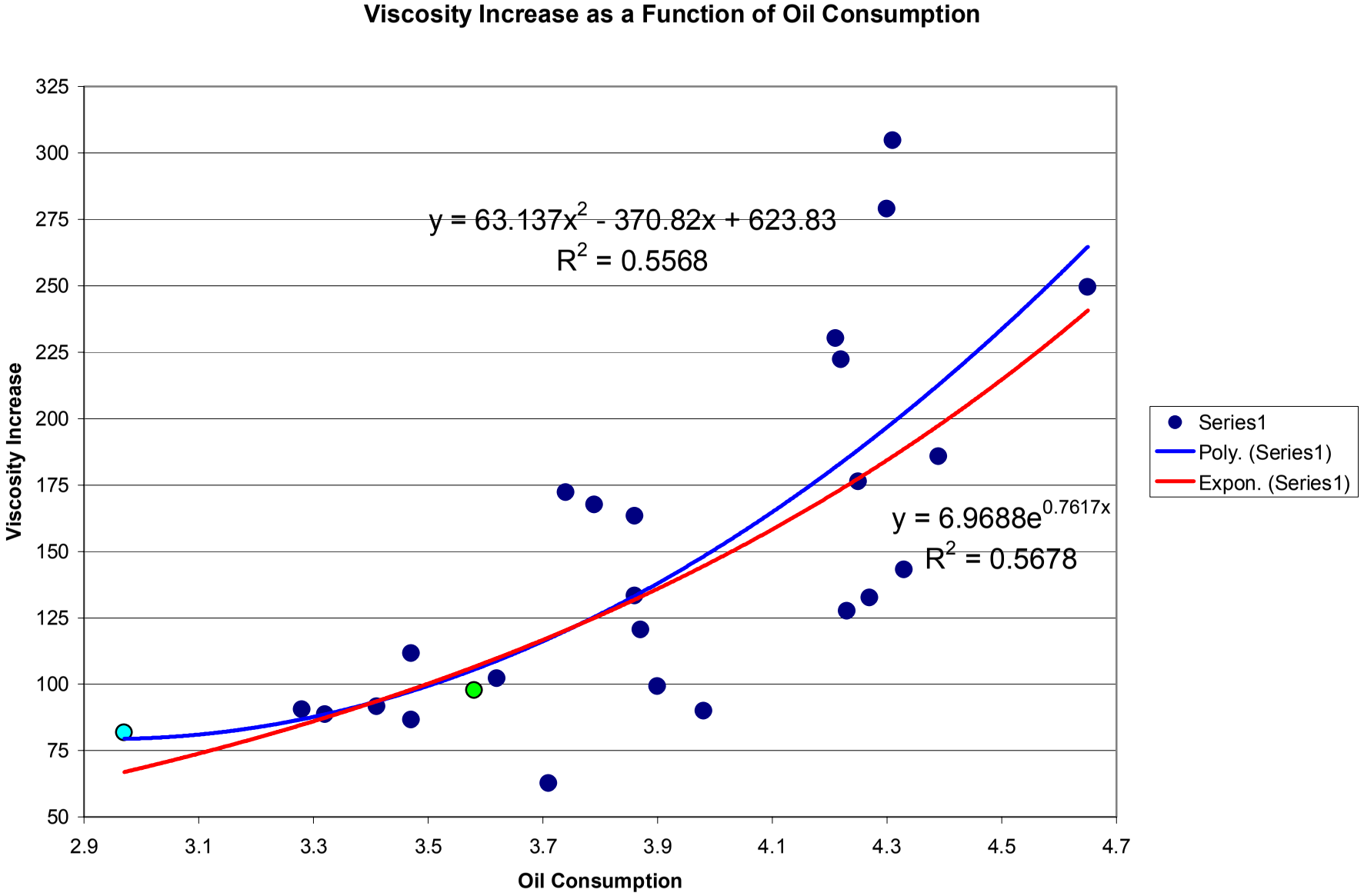
Adjusted Viscosity Increase (NVIS)

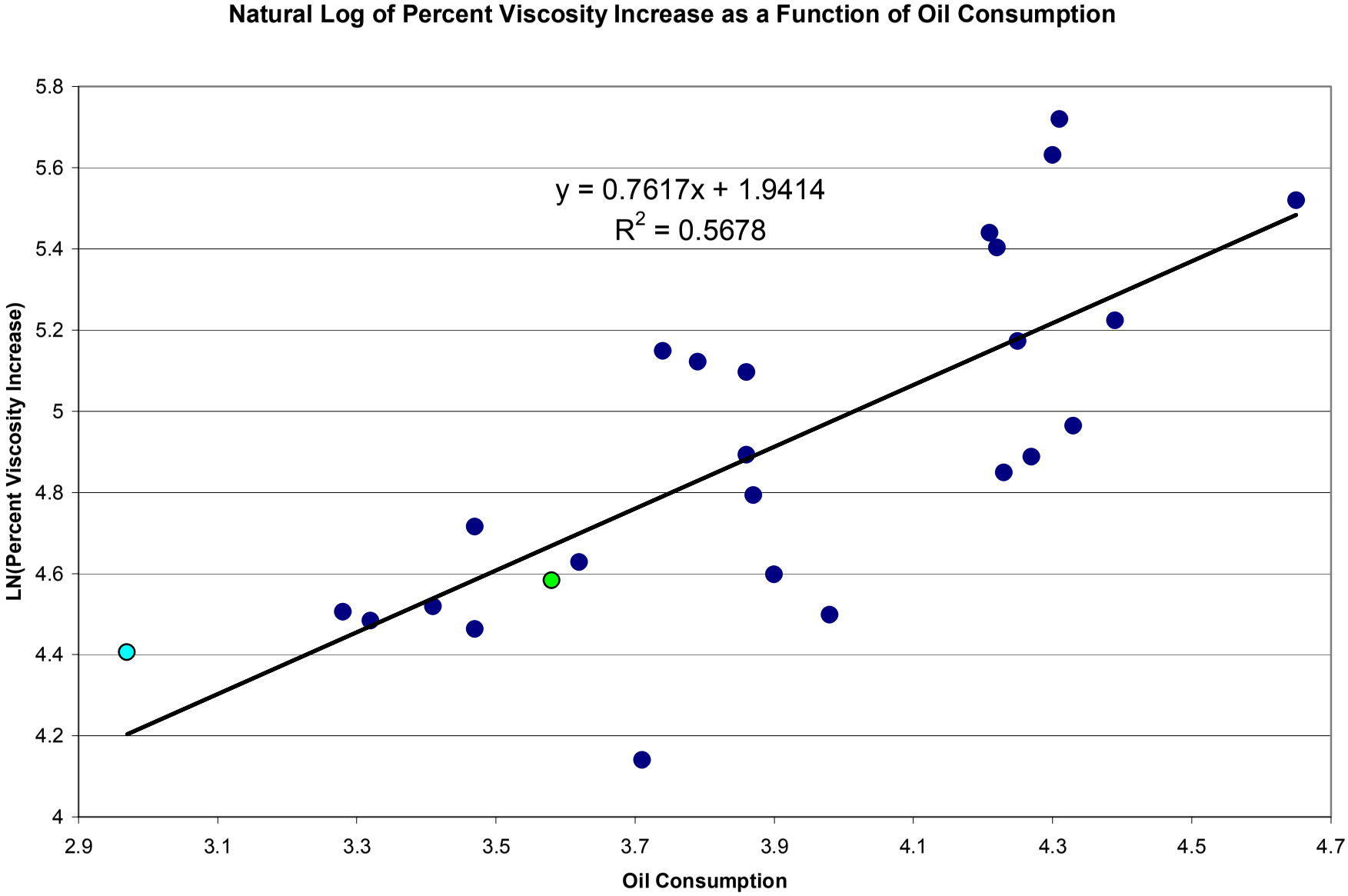
p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.000	0.350	106.40	89.18 to 123.61
Oil 435	0.000		0.001	176.79	159.58 to 194.00
Oil 438	0.350	0.001		122.97	105.75 to 140.18

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.744		133.81	119.75 to 147.86
Lab G	0.744			136.96	122.91 to 151.02

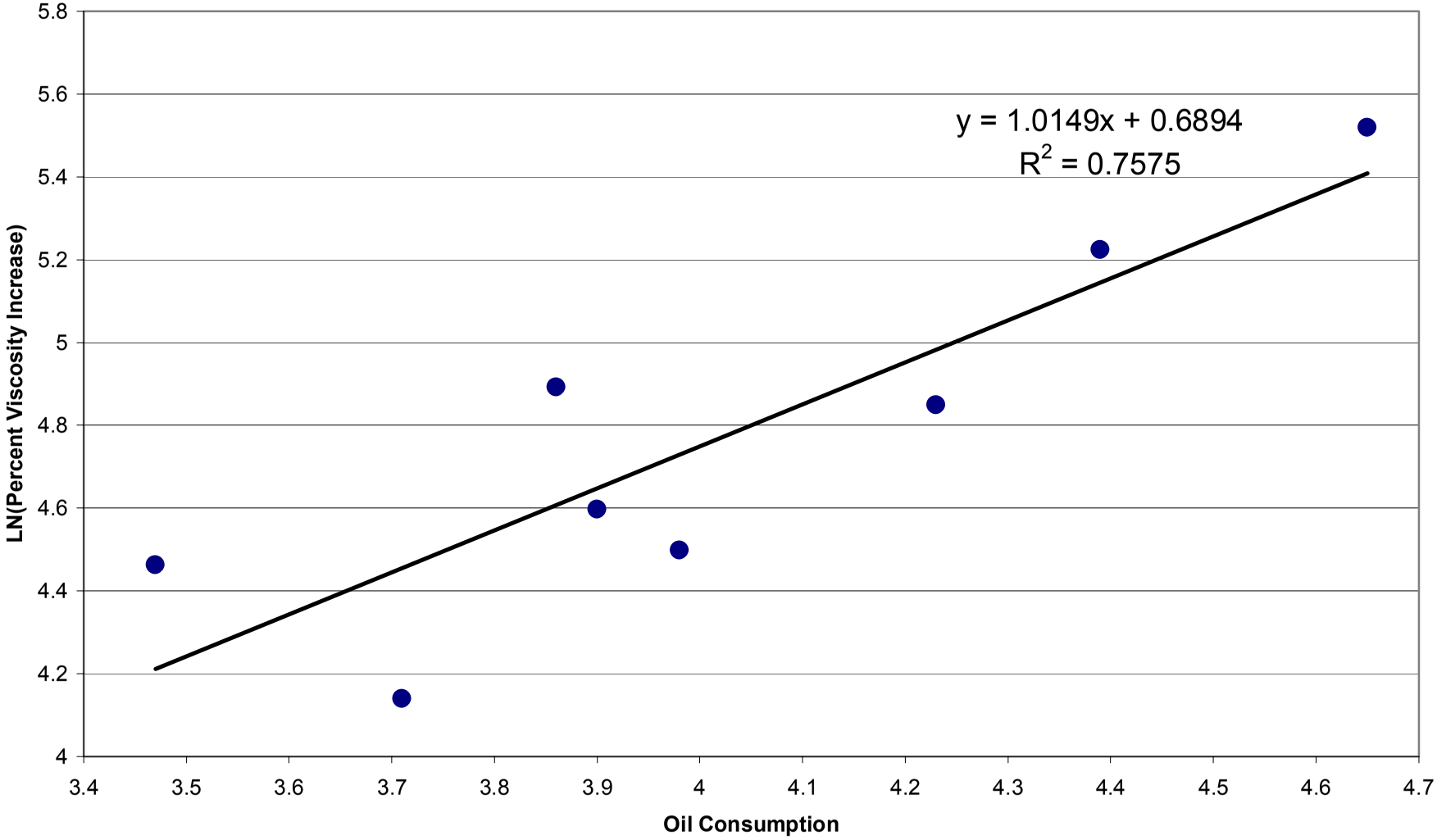

Comparison of Viscosity Increase Calculation Methods
Percent Viscosity Increase
Adjusted Viscosity Increase
Adjusted Viscosity Increase=exp((LN(VIS)) - 0.75*(OC - 3.85))
s=54
s=25
s=61
s=24
s=20
s=19
Percent Viscosity Increase
Reference Oil
320
300
280
260
240
220
200
180
160
140
120
100
80
60
432
433
434
435
436
437
438
439

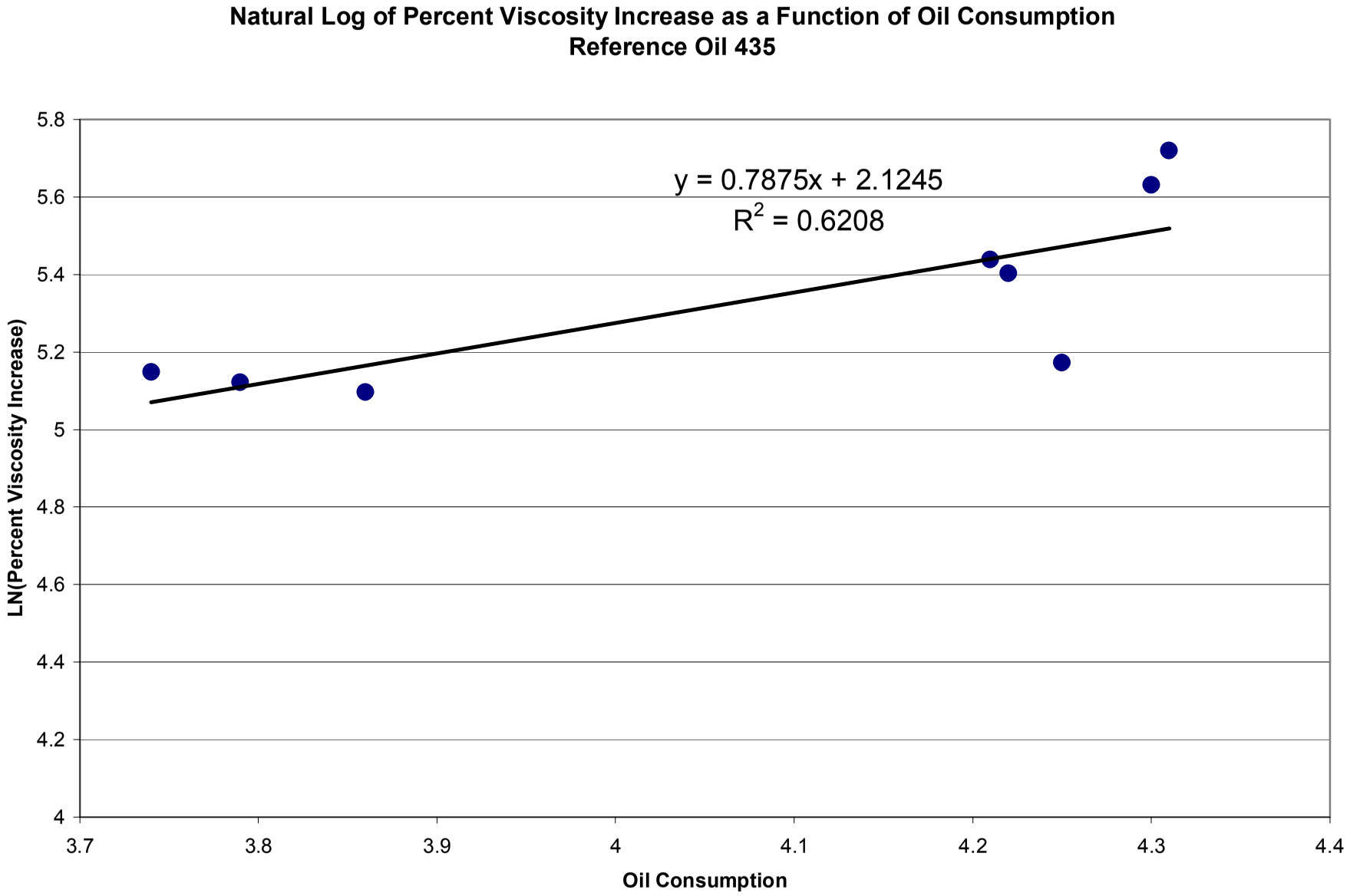

Natural Log of Viscosity Increase
A Difference in Oil Variability Remains
Even with the use of Natural Log
Natutal Log Units
5.75
5.5
5.25
5
4.75
4.5
4.25
4
432
433
434
435
436
437
438
439
Reference Oil


Viscosity Increase as a Function of Oil Consumption
y = 63.137x2 - 370.82x + 623.83
R2 = 0.5568
y = 6.9688e0.7617x
R2 = 0.5678
Viscosity Increase
Oil Consumption
325
300
275
250
225
200
175
150
125
100
75
50
2.9
3.1
3.3
3.5
3.7
3.9
4.1
4.3
4.5
4.7
Series1
Poly. (Series1)
Expon. (Series1)

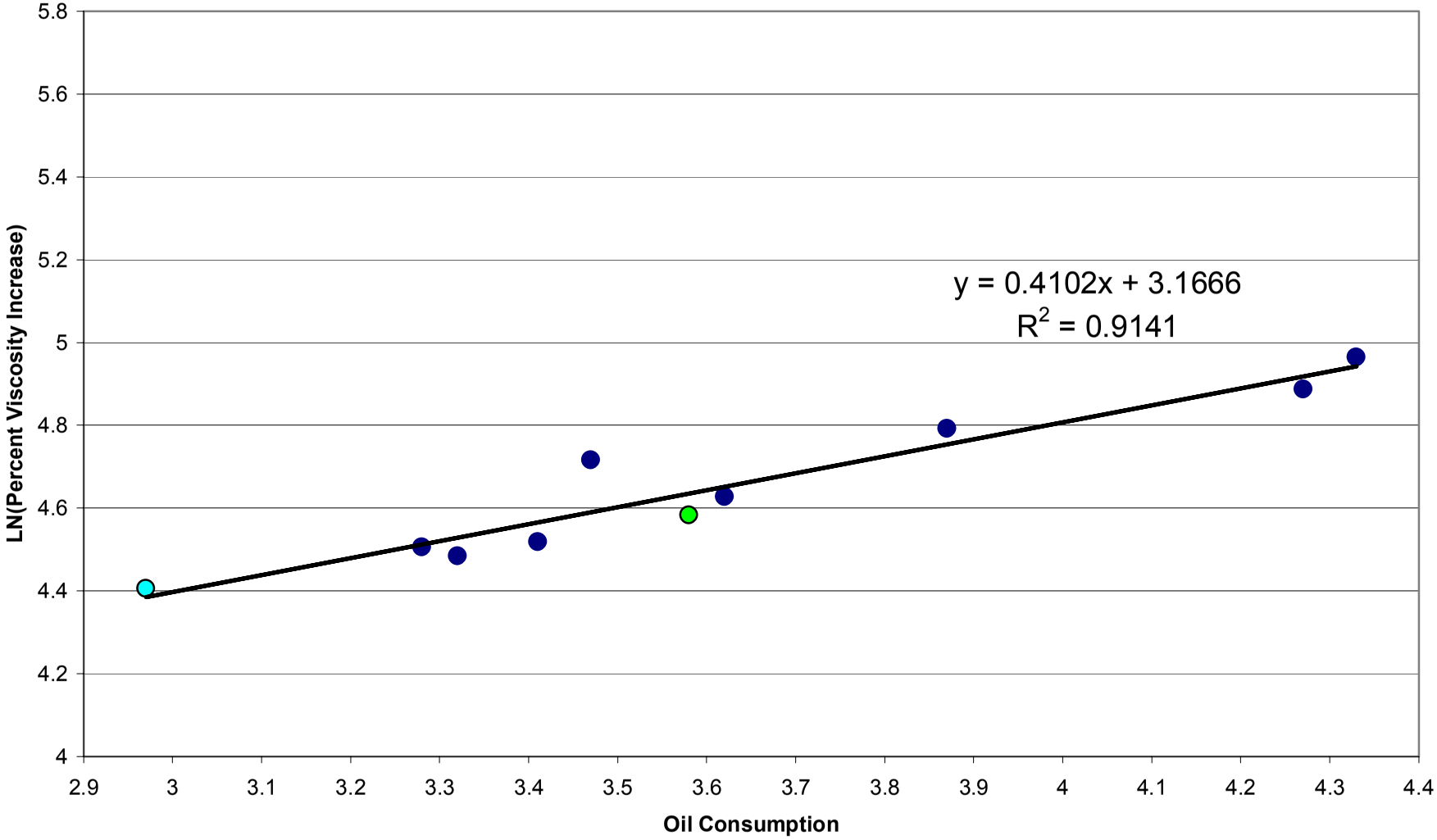

Natural Log of Percent Viscosity Increase as a Function of Oil Consumption
y = 0.7617x + 1.9414
R2 = 0.5678
LN(Percent Viscosity Increase)
Oil Consumption
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
2.9
3.1
3.3
3.5
3.7
3.9
4.1
4.3
4.5
4.7

Natural Log of Percent Viscosity Increase as a Function of Oil Consumption
Reference Oil 434




Natural Log of Percent Viscosity Increase as a Function of Oil Consumption
Reference Oil 435
y = 0.7875x + 2.1245
R2 = 0.6208
LN(Percent Viscosity Increase)
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.7
3.8
3.9
4
4.1
4.2
4.3
4.4
Oil Consumption

Natural Log of Percent Viscosity Increase as a Function of Oil Consumption
Reference Oil 438

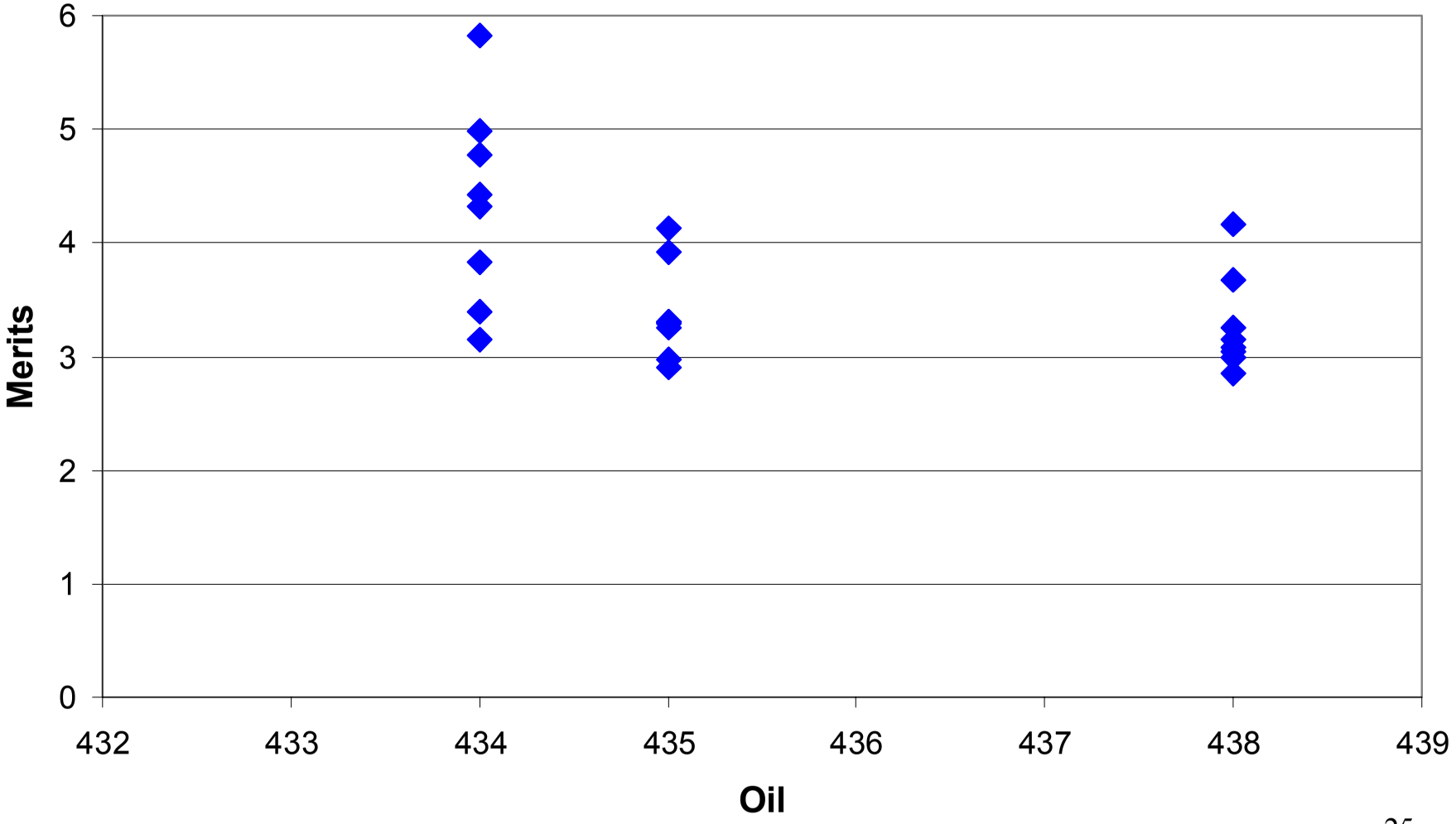


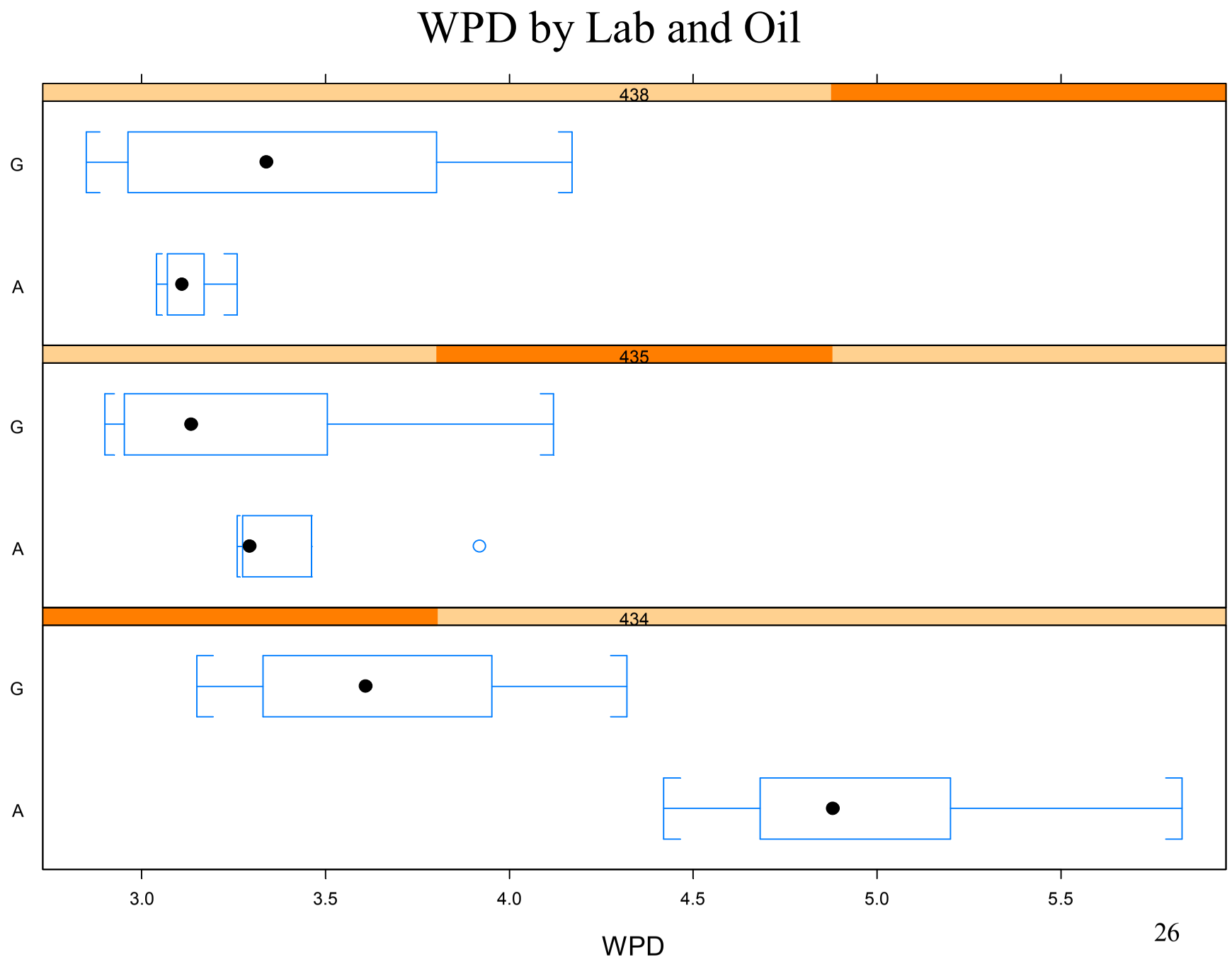
Weighted Piston Deposits (WPD)

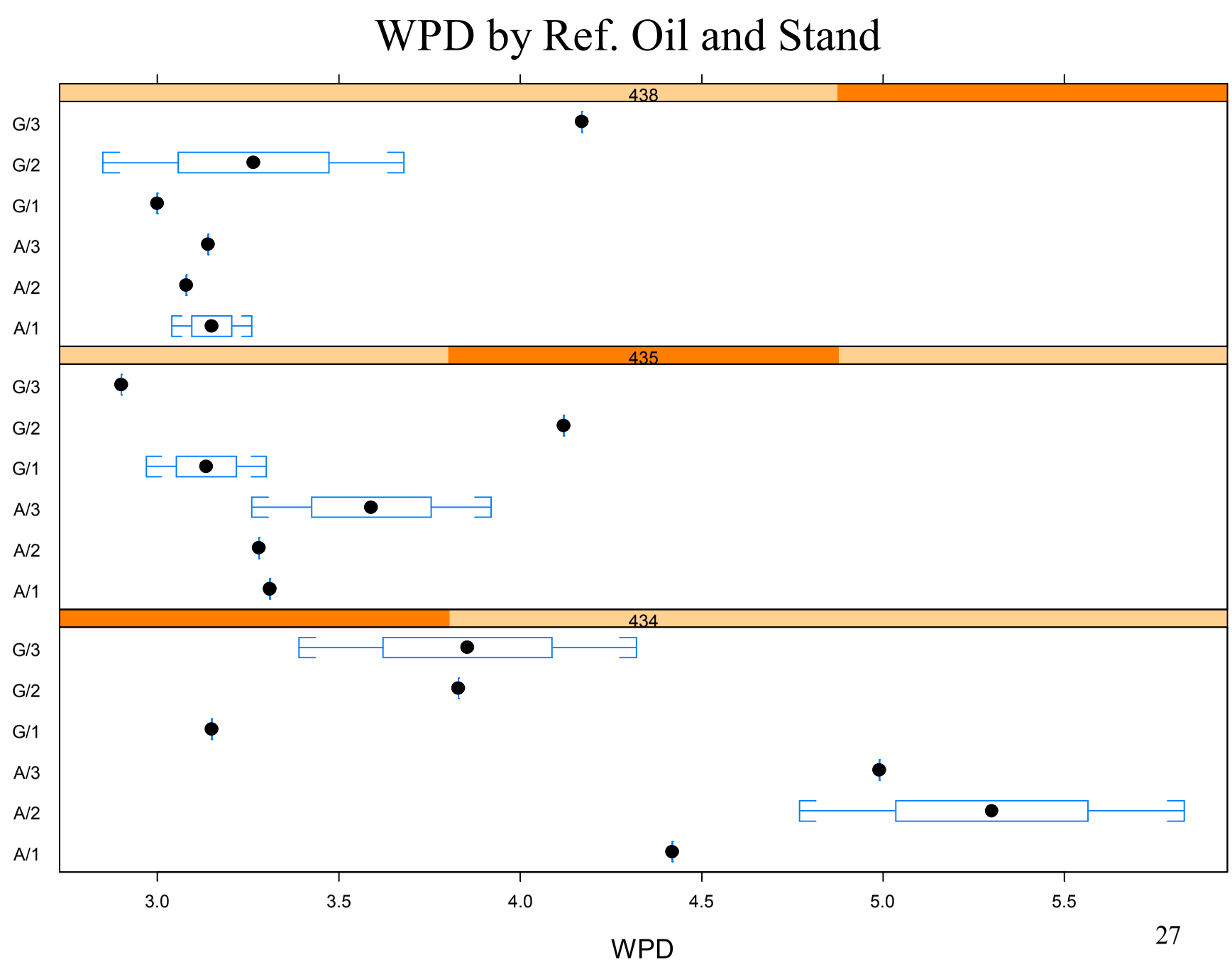
- Root Mean Squared Error=0.597072 (20 df)
- There is Evidence of a Lab Difference ONLY for Oil 434
- Strong Statistical Evidence that the Oils Differ in Lab A, But No Evidence that Oils Differ in Lab G

LAB G Data Only p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.667	0.813	3.67	3.03 to 4.31
Oil 435	0.667		0.964	3.32	2.68 to 3.96
Oil 438	0.813	0.964		3.43	2.79 to 4.06

WPD by Reference Oil




WPD by Lab and Oil
438
435
434
G
A
G
A
G
A
3.0
3.5
4.0
4.5
5.0
5.5
WPD


WPD by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
3.0
3.5
4.0
4.5
5.0
5.5
WPD

Weighted Piston Deposits (WPD)

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.012	0.005	4.34	3.90 to 4.78
Oil 435	0.012		0.934	3.38	2.94 to 3.82
Oil 438	0.005	0.934		3.28	2.84 to 3.72

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.130		3.86	3.50 to 4.22
Lab G	0.130			3.47	3.11 to 3.83

New Weighted Piston Deposits (NWPD)

- This is one Example of a Weighting Change
- Root Mean Squared Error=0.466414 (20 df)
- There is Evidence of a Lab Difference ONLY for Oil 434
- Strong Statistical Evidence that the Oils Differ in Lab A, But No Evidence that Oils Differ in Lab G

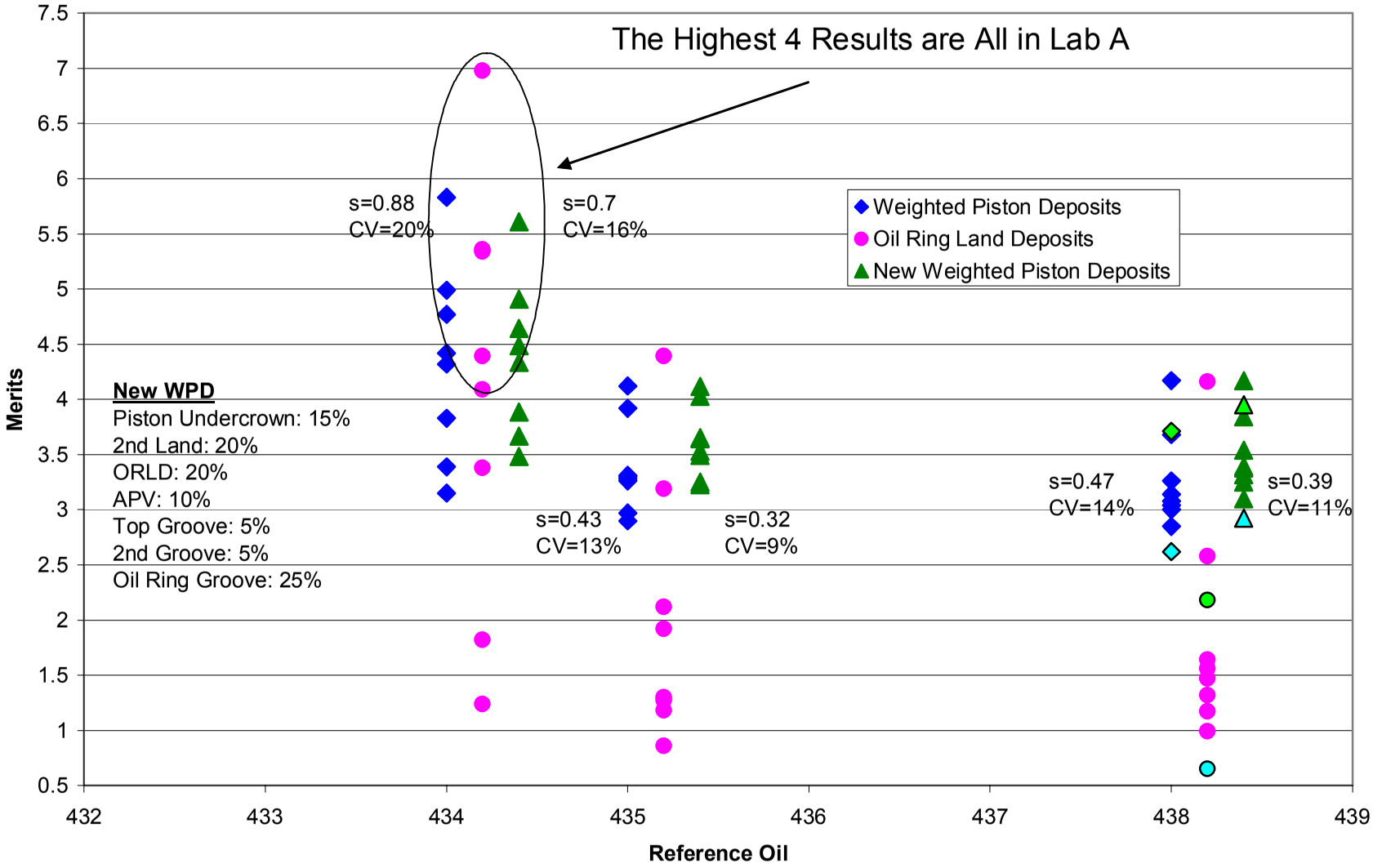
LAB G Data Only p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.644	0.698	3.84	3.35 to 4.33
Oil 435	0.644		0.995	3.56	3.07 to 4.05
Oil 438	0.698	0.995		3.59	3.10 to 4.08

New Weighted Piston Deposits (NWPD)

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.011	0.003	4.38	4.03 to 4.72
Oil 435	0.011		0.868	3.62	3.27 to 3.96
Oil 438	0.003	0.868		3.50	3.15 to 3.84

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.096		4.00	3.72 to 4.28
Lab G	0.096			3.67	3.38 to 3.95

Comparison of Weighted Deposits



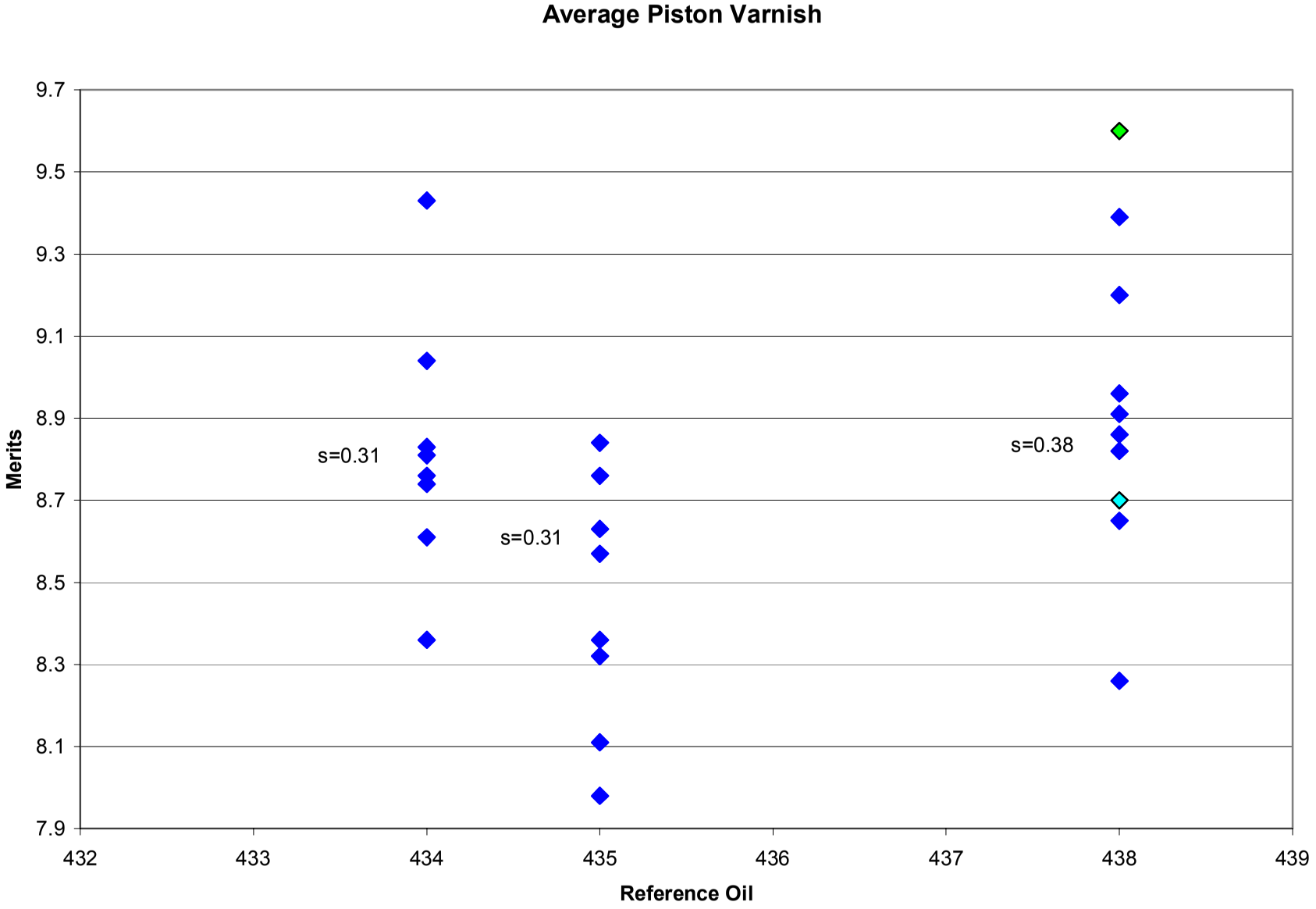
Average Piston Varnish (APV)

- Root Mean Squared Error=0.320346 (20 df)
- No Statistical Evidence that the Labs Differ
- Statistical Evidence that the Oils Differ

Average Piston Varnish (APV)

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.072	0.929	8.82	8.59 to 9.06
Oil 435	0.072		0.034	8.45	8.21 to 8.68
Oil 438	0.929	0.034		8.88	8.64 to 9.12

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.332		8.78	8.59 to 8.97
Lab G	0.332			8.65	8.46 to 8.84


Average Piston Varnish
9.7
9.5
9.3
9.1
8.9
8.7
8.5
8.3
8.1
7.9
Merits
s=0.31
s=0.31
s=0.38
432
433
434
435
436
437
438
439
Reference Oil

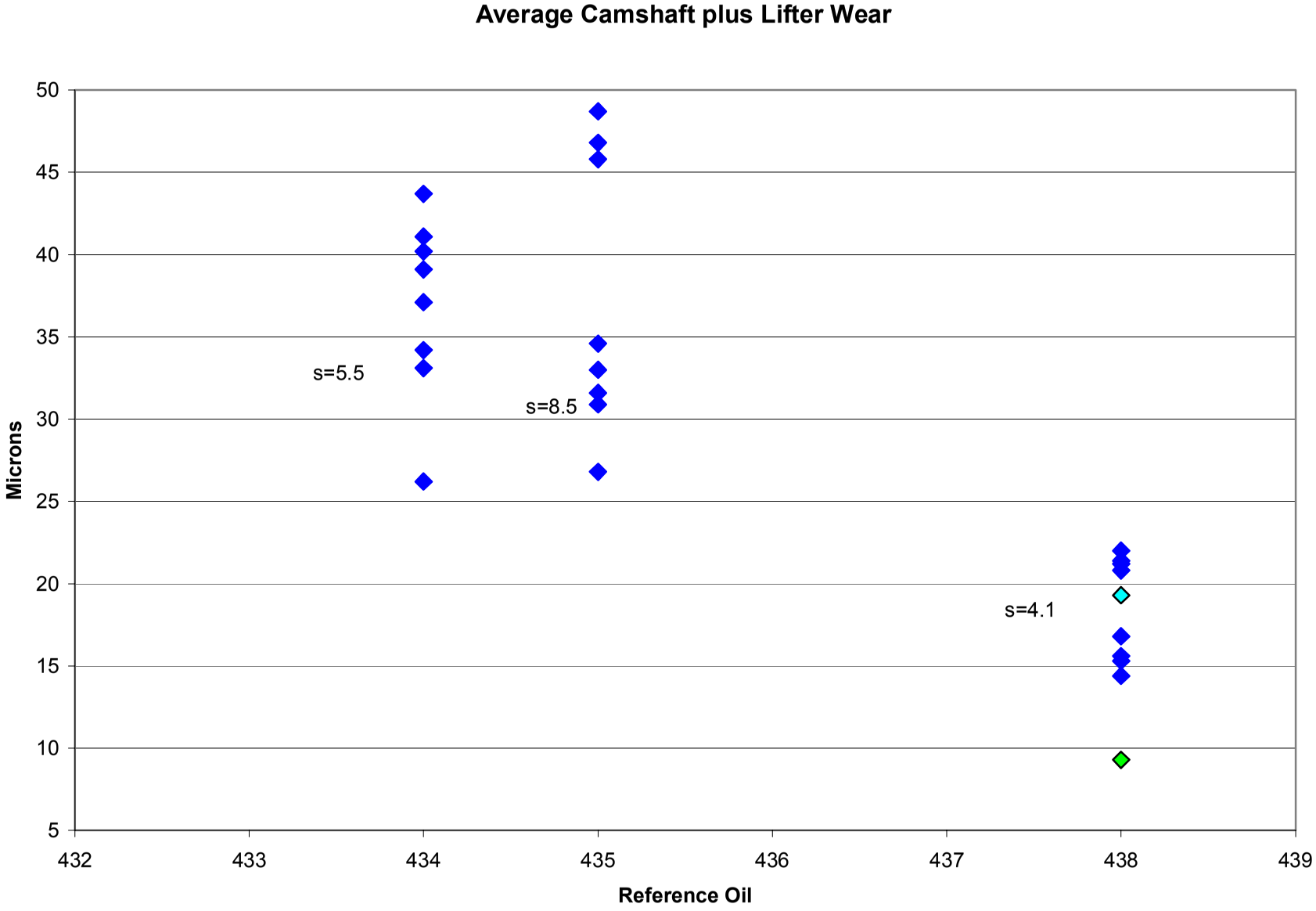
Average Camshaft plus Lifter Wear (ACLW)

- Analyzed on Natural Log Scale
- Root Mean Squared Error=0.193585 (20 df)
- No Statistical Evidence that the Labs Differ
- Strong Statistical Evidence that the Oils Differ

Average Camshaft plus Lifter Wear (ACLW)

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		1.000	0.000	36.44	31.59 to 42.03
Oil 435	1.000		0.000	36.45	31.60 to 42.05
Oil 438	0.000	0.000		18.19	15.77 to 20.98

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.673		29.40	26.17 to 33.04
Lab G	0.673			28.42	25.30 to 31.94


Average Camshaft plus Lifter Wear
Microns
50
45
40
35
30
25
20
15
10
5
s=5.5
s=8.5
s=4.1
432
433
434
435
436
437
438
439
Reference Oil

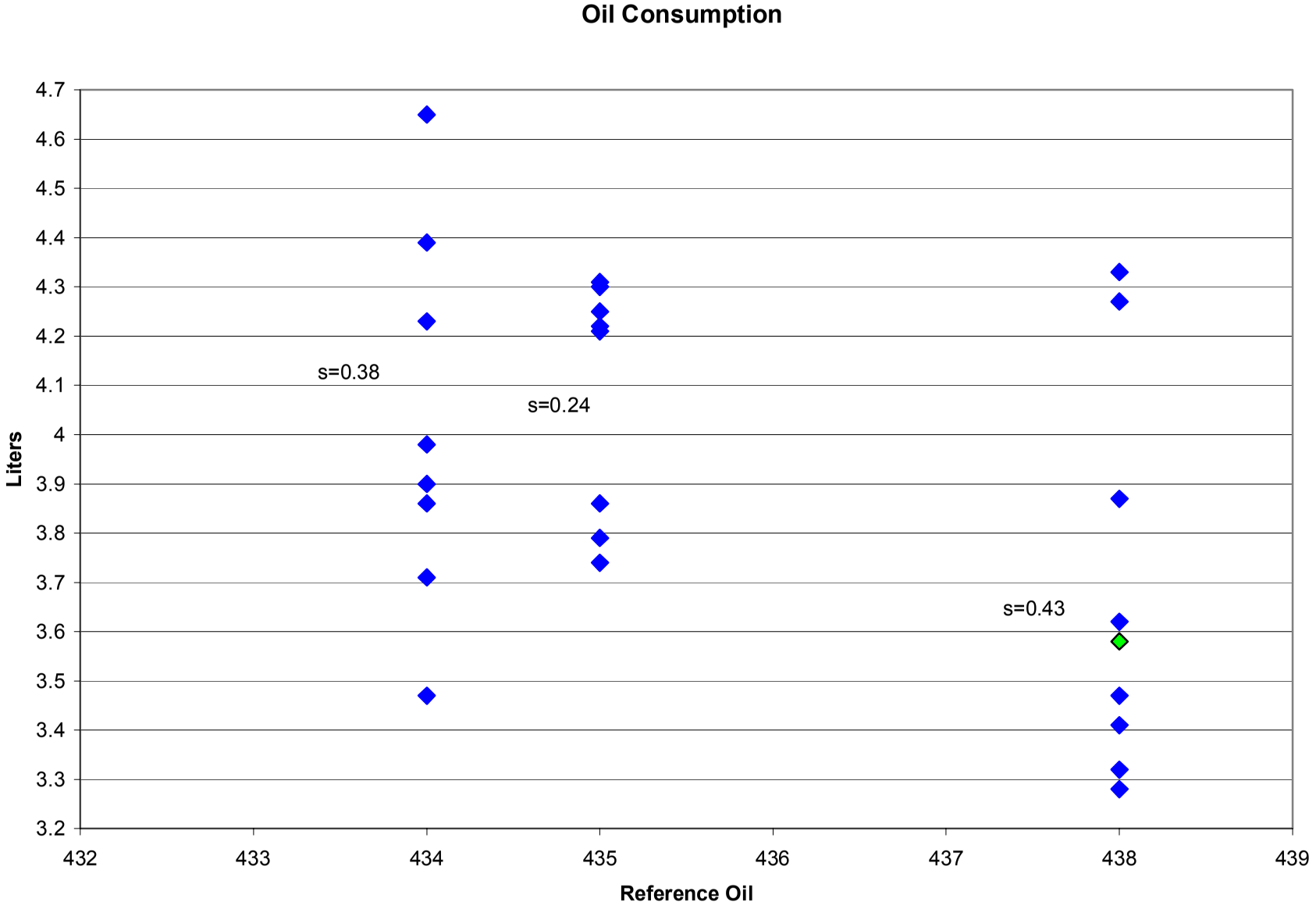
Oil Consumption (OC)

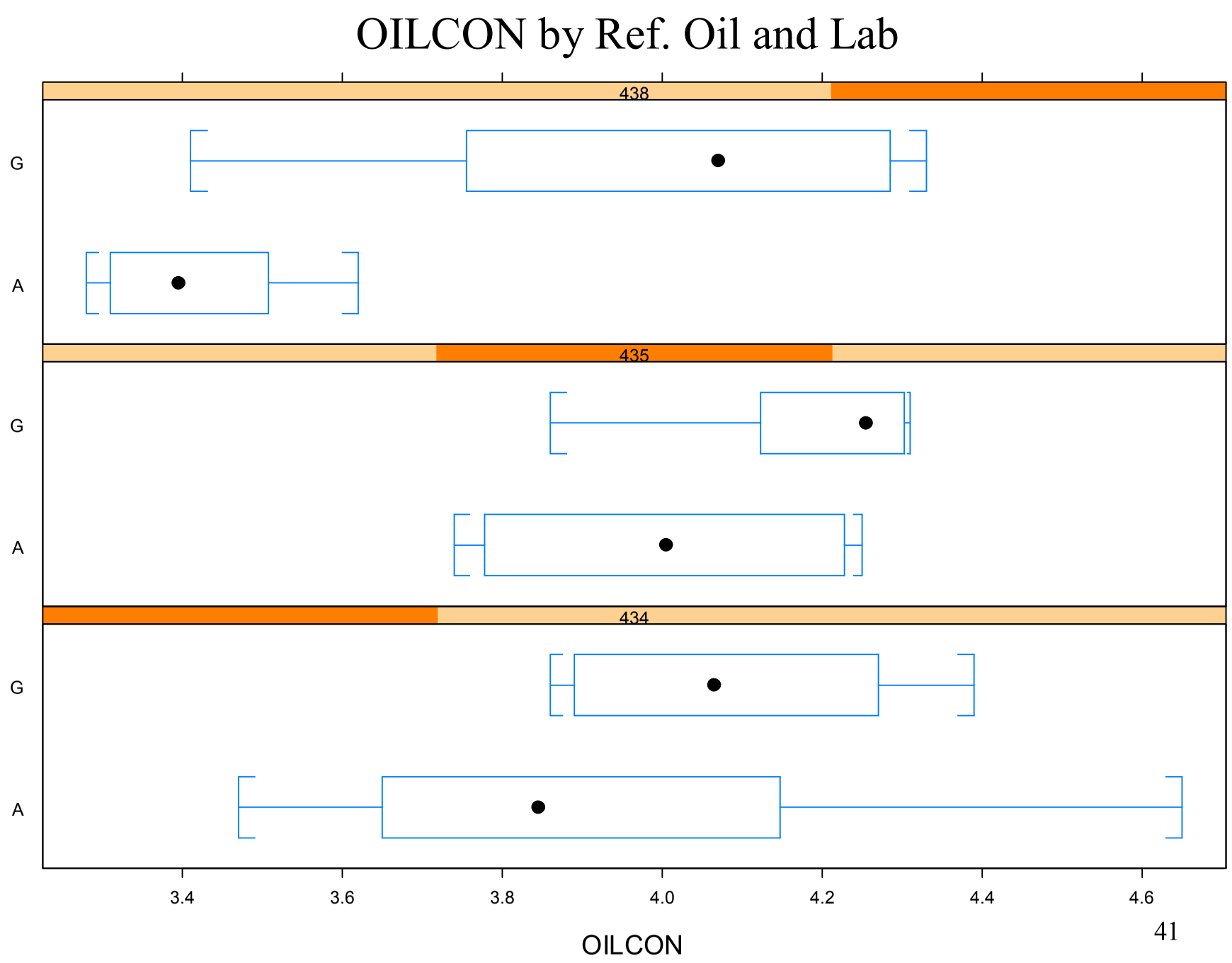
- Weak Evidence of a Stand Effect (Stand not Fit in Final Model)
- Root Mean Squared Error=0.3282 (20 df)
- Statistical Evidence that the Labs Differ
- Some Statistical Evidence that the Oils Differ

Oil Consumption (OC)

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.926	0.138	4.02	3.78 to 4.27
Oil 435	0.926		0.069	4.09	3.84 to 4.33
Oil 438	0.138	0.069		3.70	3.45 to 3.94

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.045		3.79	3.59 to 3.99
Lab G	0.045			4.08	3.88 to 4.28


Oil Consumption
Liters
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
s=0.38
s=0.24
s=0.43
432
433
434
435
436
437
438
439
Reference Oil


OILCON by Ref. Oil and Lab
438
435
434
G
A
3.4
3.6
3.8
4.0
4.2
4.4
4.6
OILCON

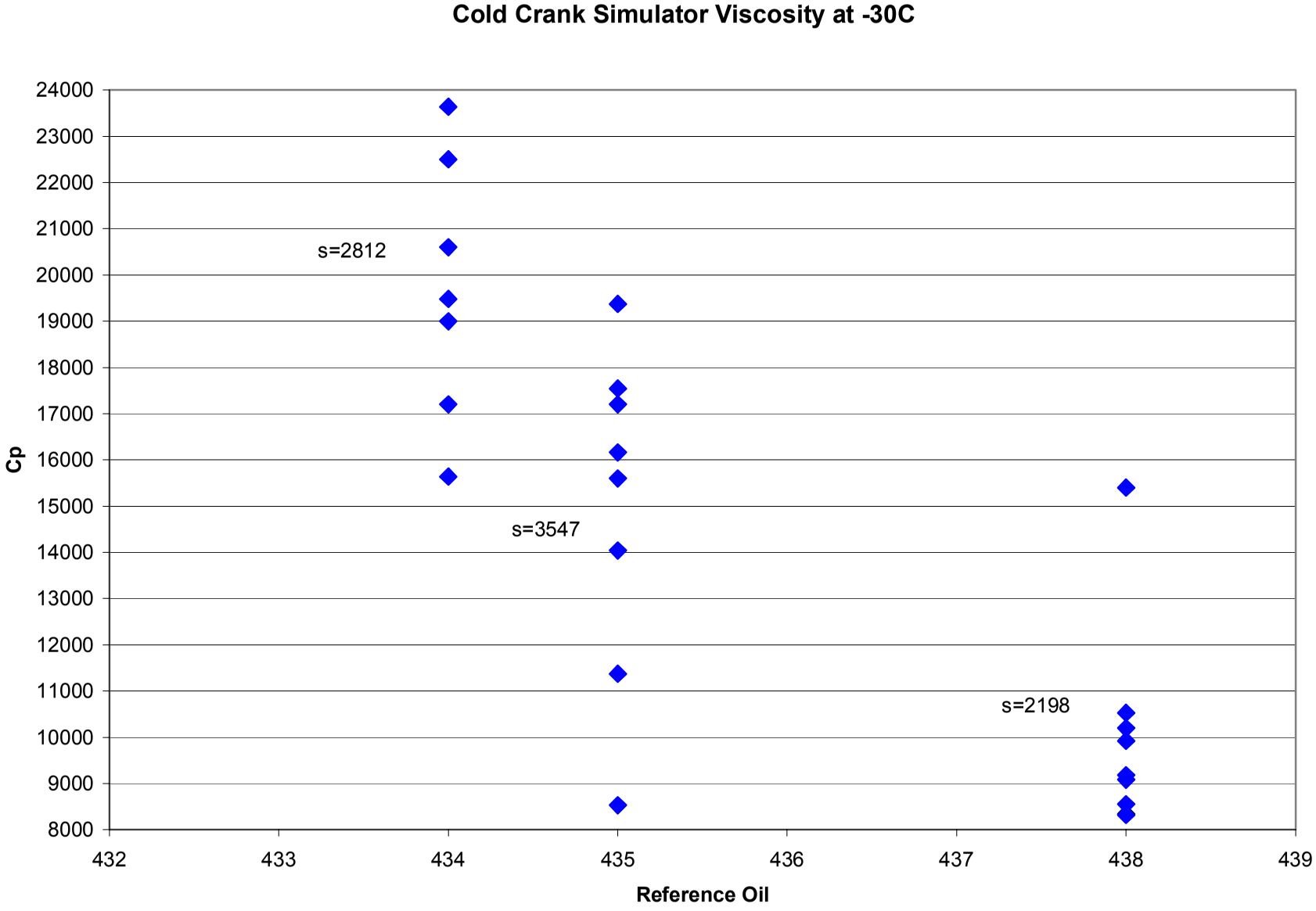
Cold Crank Simulator Viscosity (CCS)

- Only 23 Out of 24 Matrix Results Available
- Root Mean Squared Error=3001.769 (19 df)
- No Statistical Evidence that the Labs Differ
- Strong Statistical Evidence that the Oils Differ

Cold Crank Simulator Viscosity (CCS)

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.014	0.000	19,716	17,485 to 22,192
Oil 435	0.014		0.011	14,976	12,789 to 17,164
Oil 438	0.000	0.011		10,148	7960 to 12,335

p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.944		14,992	13,178 to 16,805
Lab G	0.944			14,902	13,000 to 16,804


Cold Crank Simulator Viscosity at -30C
Cp
24000
23000
22000
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
s=2812
s=3547
s=2198
432
433
434
435
436
437
438
439
Reference Oil

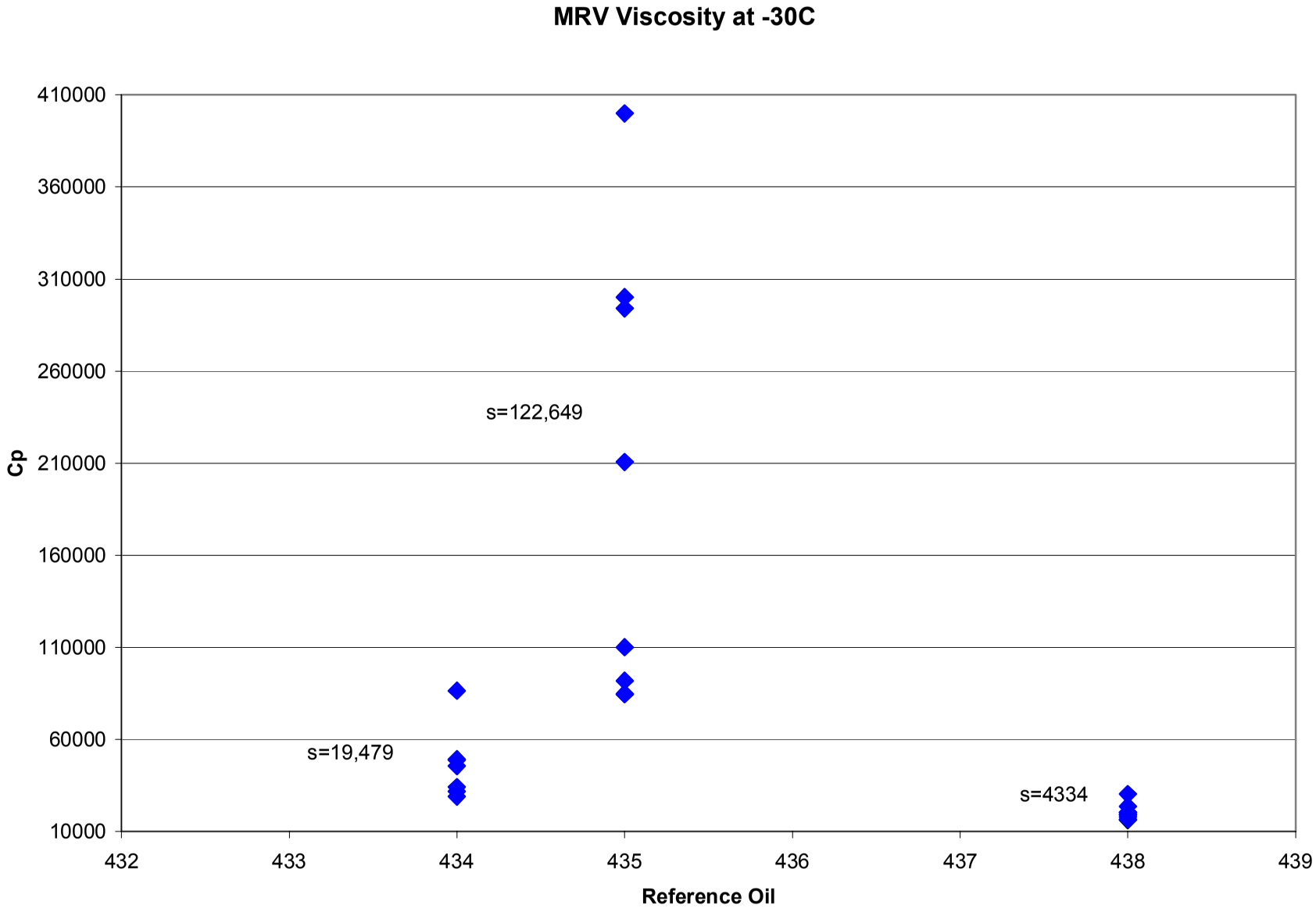
MRV Viscosity (MRV)

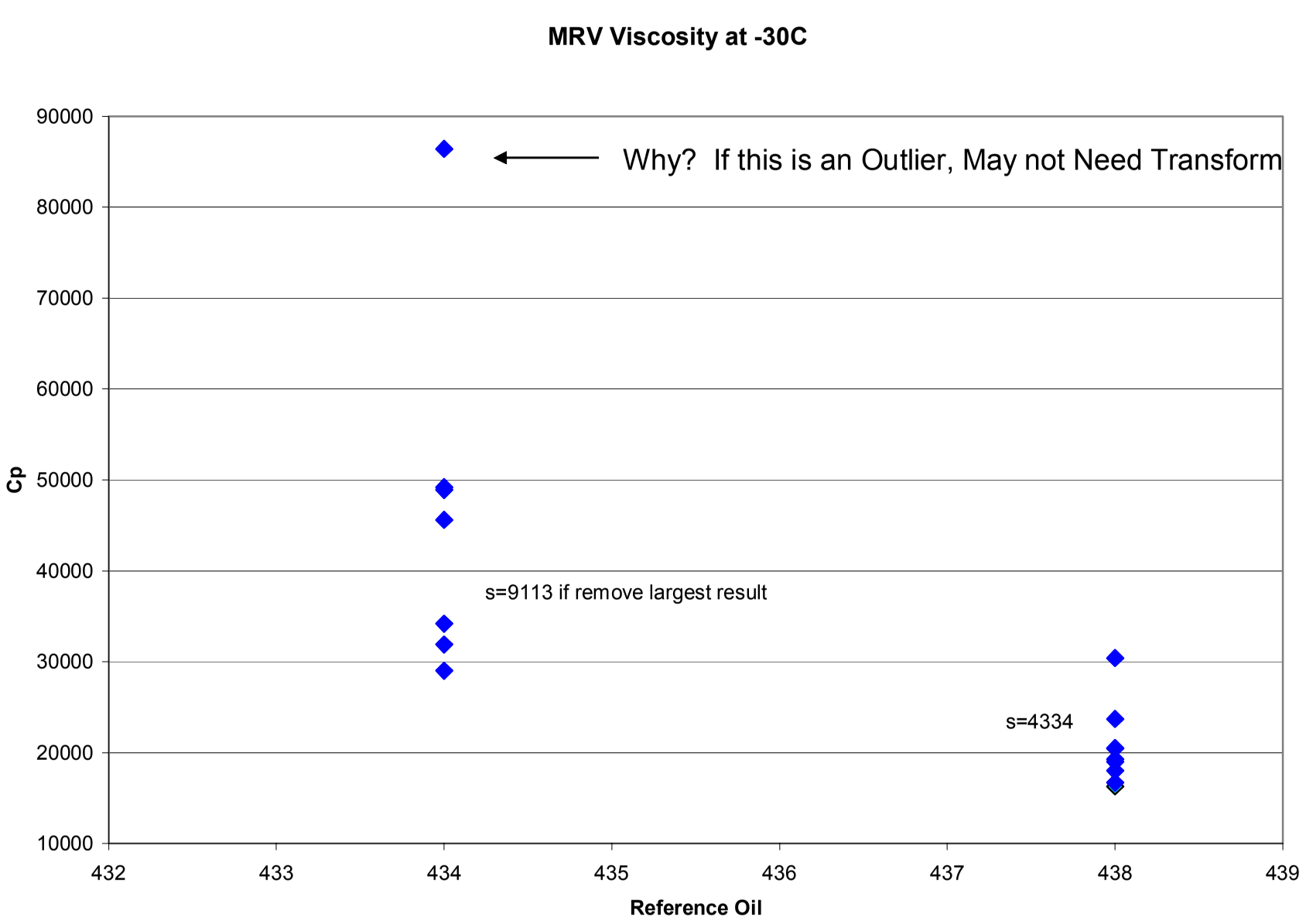
- Only 23 Out of 24 Matrix Results Available
- Analyzed on Inverse Square Root Scale
- Weak Evidence of a Stand Effect (Stand not Fit in Final Model)
- Root Mean Squared Error=0.000695 (19 df)
- Statistical Evidence that the Labs Differ
- Strong Statistical Evidence that the Oils Differ
- Analysis Performed with and without Oil 435, but Transformation Holds, Oil Discrimination Holds, and Standard Deviation in Transformed Units Remains Approximately the Same (Note, However, that there is only Some Evidence of Lab Effects)

MRV Viscosity (MRV)

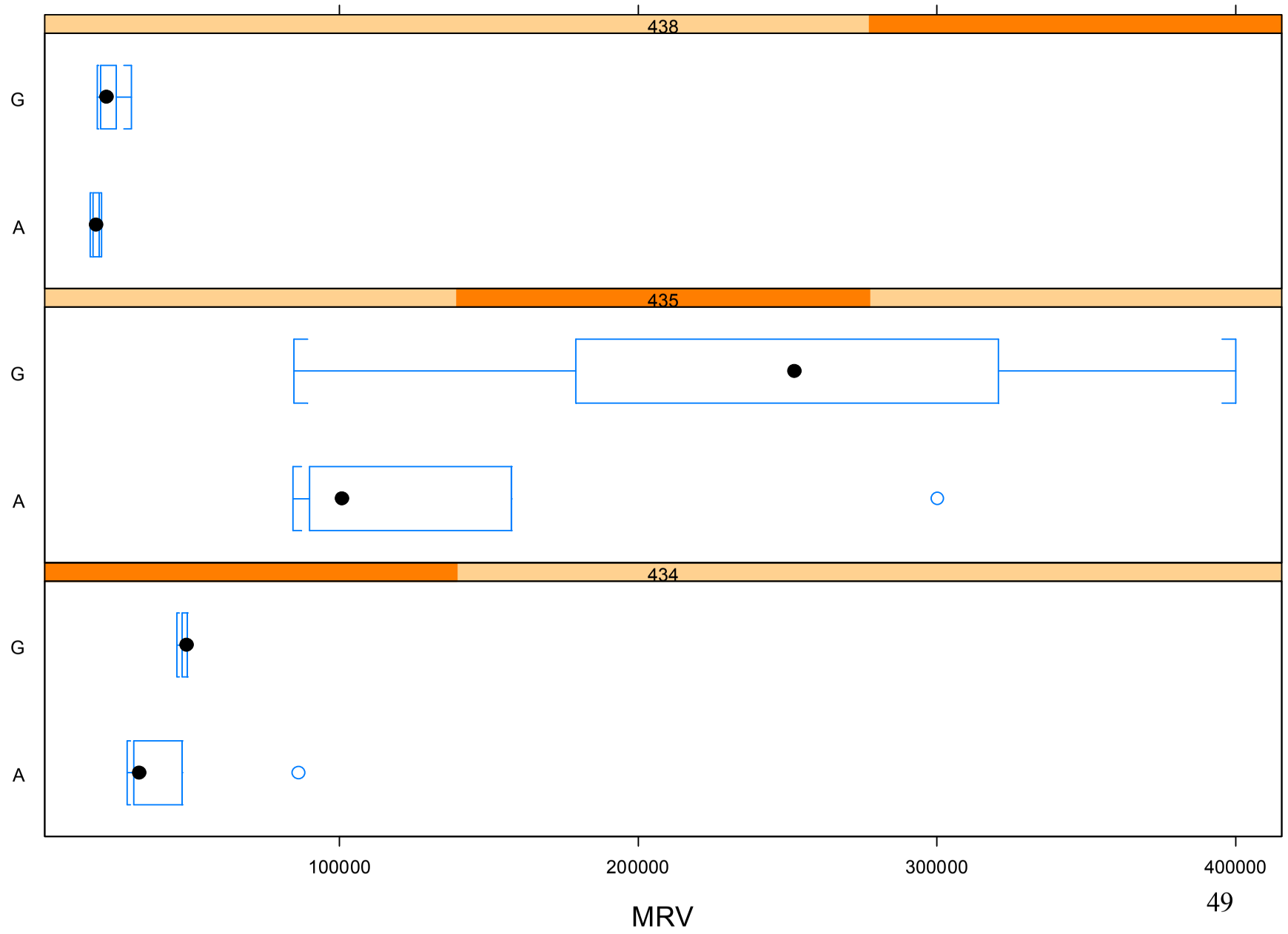
p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	434	435	438		
Oil 434		0.000	0.000	43,187	34,768 to 55,104
Oil 435	0.000		0.000	150,581	104,665 to 234,964
Oil 438	0.000	0.000		20,519	17,802 to 23,918

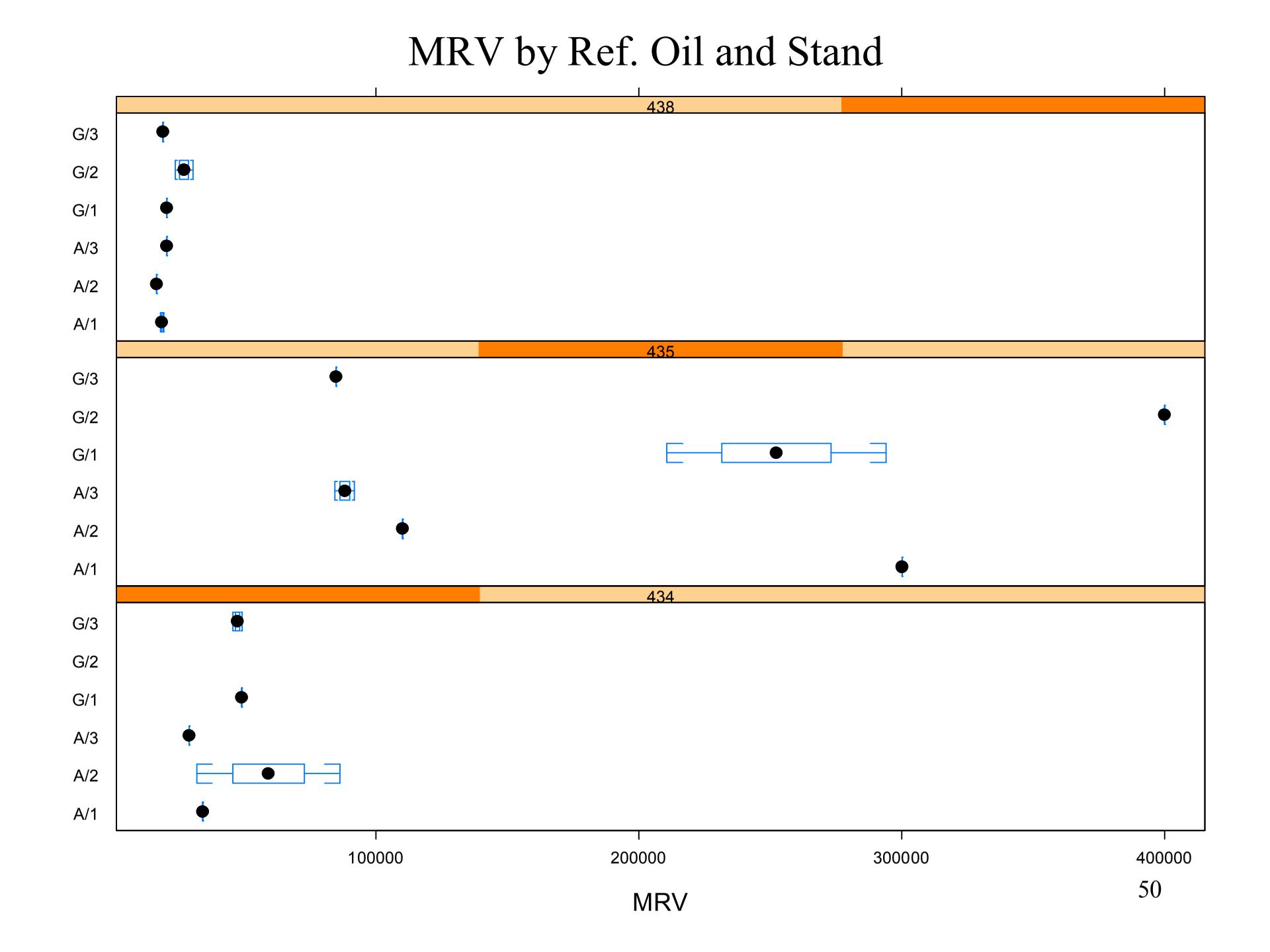
p-values in Hypothesis Test of No Difference				Mean	95% Confidence Interval for the Mean
	Lab A	Lab G			
Lab A		0.044		38,402	32,783 to 45,599
Lab G	0.044			49,891	41,362 to 61,390


MRV Viscosity at -30C
410000
360000
310000
260000
210000
160000
110000
60000
10000
Cp
s=122,649
s=19,479
s=4334
432
433
434
435
436
437
438
439
Reference Oil


MRV Viscosity at -30C
Why? If this is an Outlier, May not Need Transform
s=9113 if remove largest result
s=4334
Cp
Reference Oil
90000
80000
70000
60000
50000
40000
30000
20000
10000
432
433
434
435
436
437
438
439

MRV by Ref. Oil and Lab




MRV by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
100000
200000
300000
400000
MRV

Summary of Means and Standard Deviations by Oil

	VIS		LN(VIS)		NVIS	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Oil 434	129.34	61.35	4.7729	0.4447	106.40	24.42
Oil 435	214.49	54.33	5.3416	0.2433	176.79	25.47
Oil 438	110.15	20.57	4.6870	0.1832	122.97	17.89
Model Std Dev		48.78		0.2919		23.34
ACC Ep		**0.62**		**0.77**		**1.29**

Summary of Means and Standard Deviations by Oil

	APV		WPD		NWPD	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Oil 434	8.82	0.31	4.34	0.88	4.38	0.70
Oil 435	8.45	0.31	3.38	0.43	3.62	0.32
Oil 438	8.88	0.34	3.28	0.44	3.50	0.35
Model Std Dev		0.32		0.60		0.47
ACC Ep		**0.94**		**0.50**		**0.65**

Summary of Means and Standard Deviations by Oil

	ACLW		LN(ACLW)		OC	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Oil 434	36.84	5.55	3.5956	0.1624	4.02	0.38
Oil 435	37.28	8.47	3.5961	0.2247	4.09	0.24
Oil 438	18.44	3.20	2.9009	0.1767	3.70	0.42
Model Std Dev		6.13		0.1936		0.33
ACC Ep		**1.63**		**1.87**		**1.53**

Summary of Means and Standard Deviations by Oil

	CCS		MRV		1/SQRT(MRV)	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Oil 434	19,723	2812	46,457 (39,800)	19,479 (9113)	0.00485629	0.00084309
Oil 435	14,976	3547	197,025	122,649	0.00257696	0.00079675
Oil 438	10,148	2260	21,013	4318	0.00698055	0.00062174
Model Std Dev		3002	434,438 only	7131		0.000695
ACC Ep		**0.27**		**1.12**		**~1**

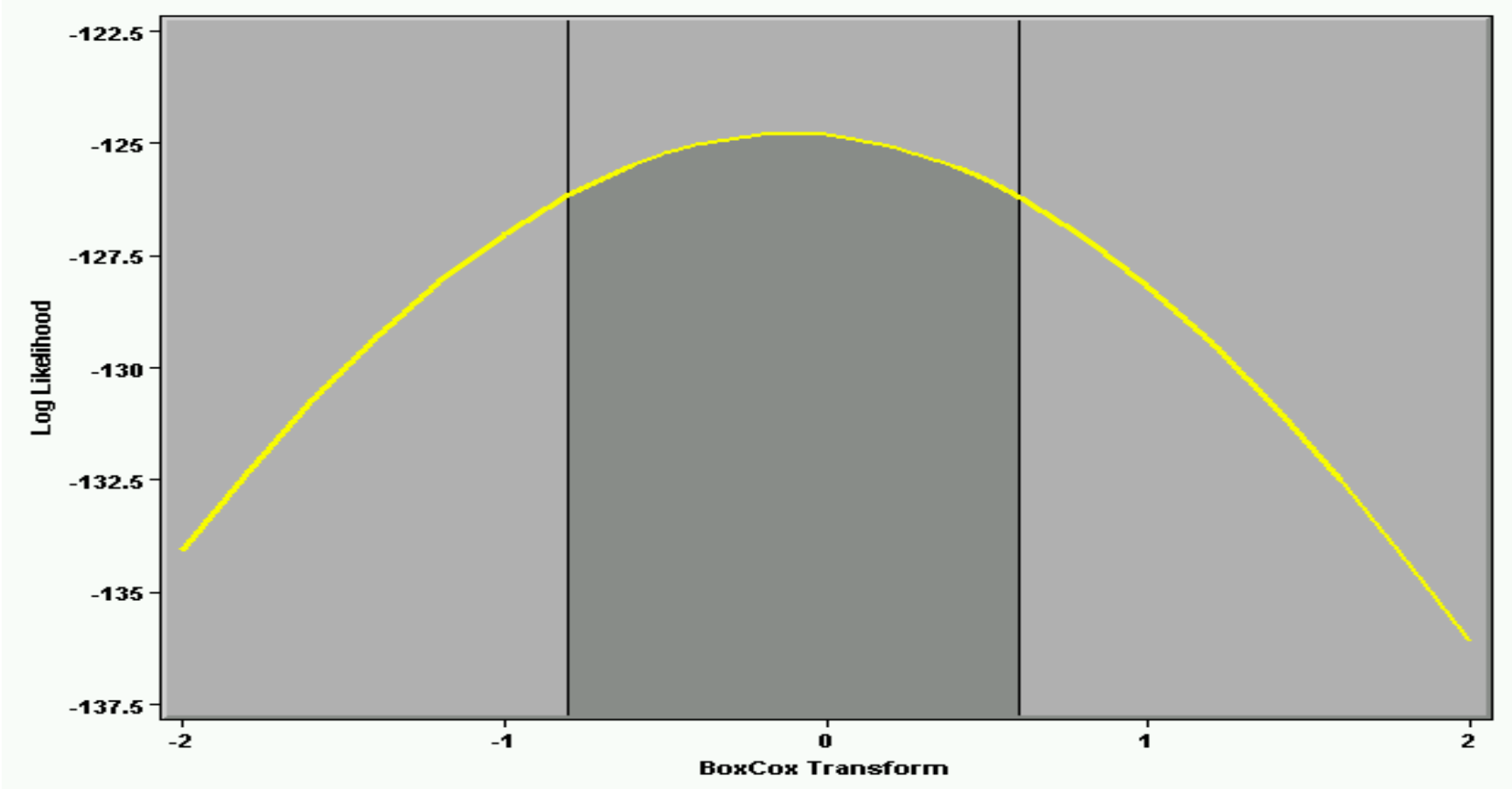
Appendix

- Transformation Plots and Run Order Effect Plots
- Plots of the data for each parameter by Lab and by Stand
- Summary of unusual observations by parameter
- Correlation of MRV and PVIS:
  - Used Oil MRV over Fresh Oil MRV versus PVIS
  - Used Oil MRV over Fresh Oil MRV versus PVIS by Oil

Transformation Analysis and Residual Plots by Time Order

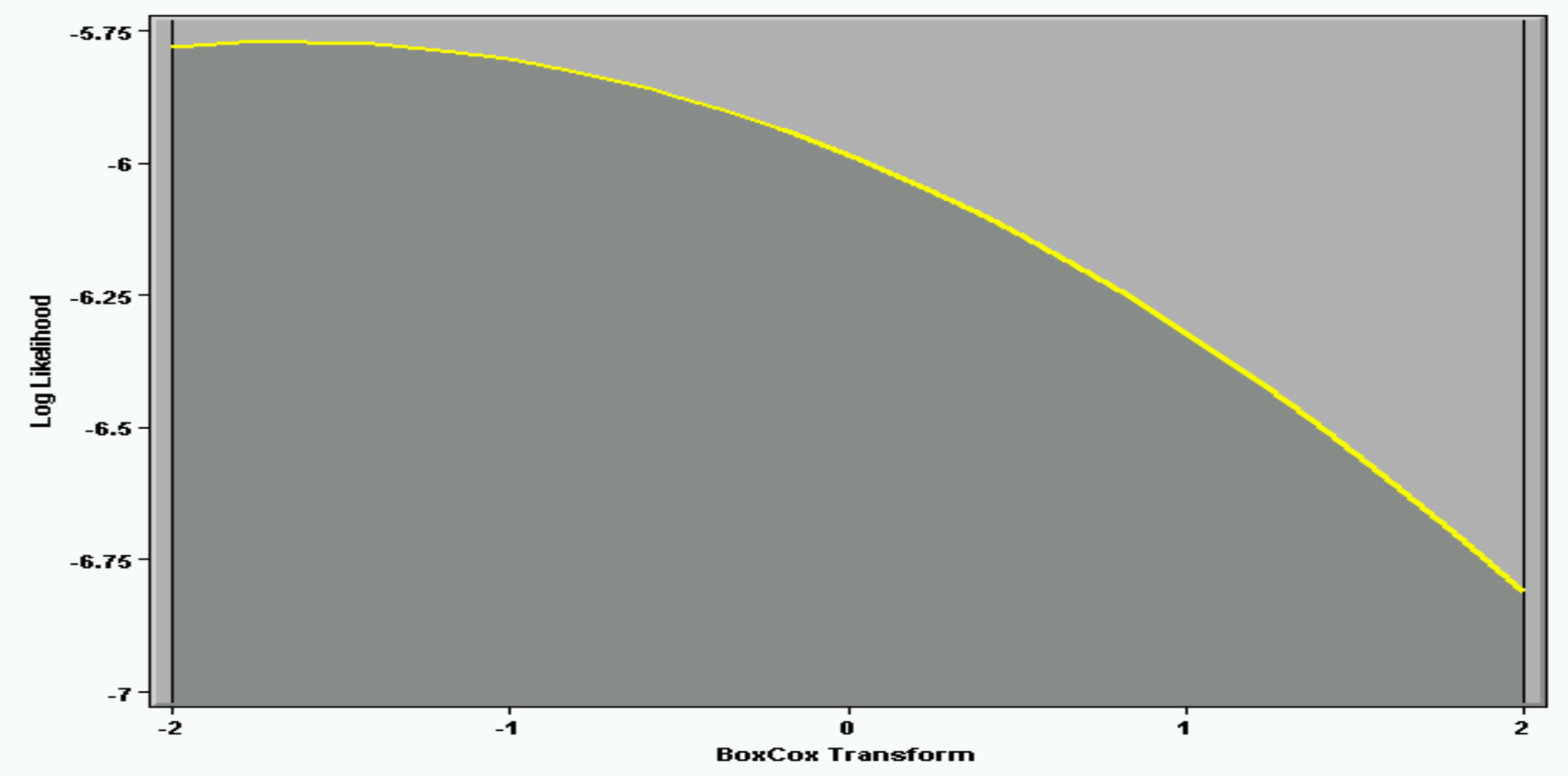
Box Cox Transformation

% Viscosity Increase BoxCox Transformation



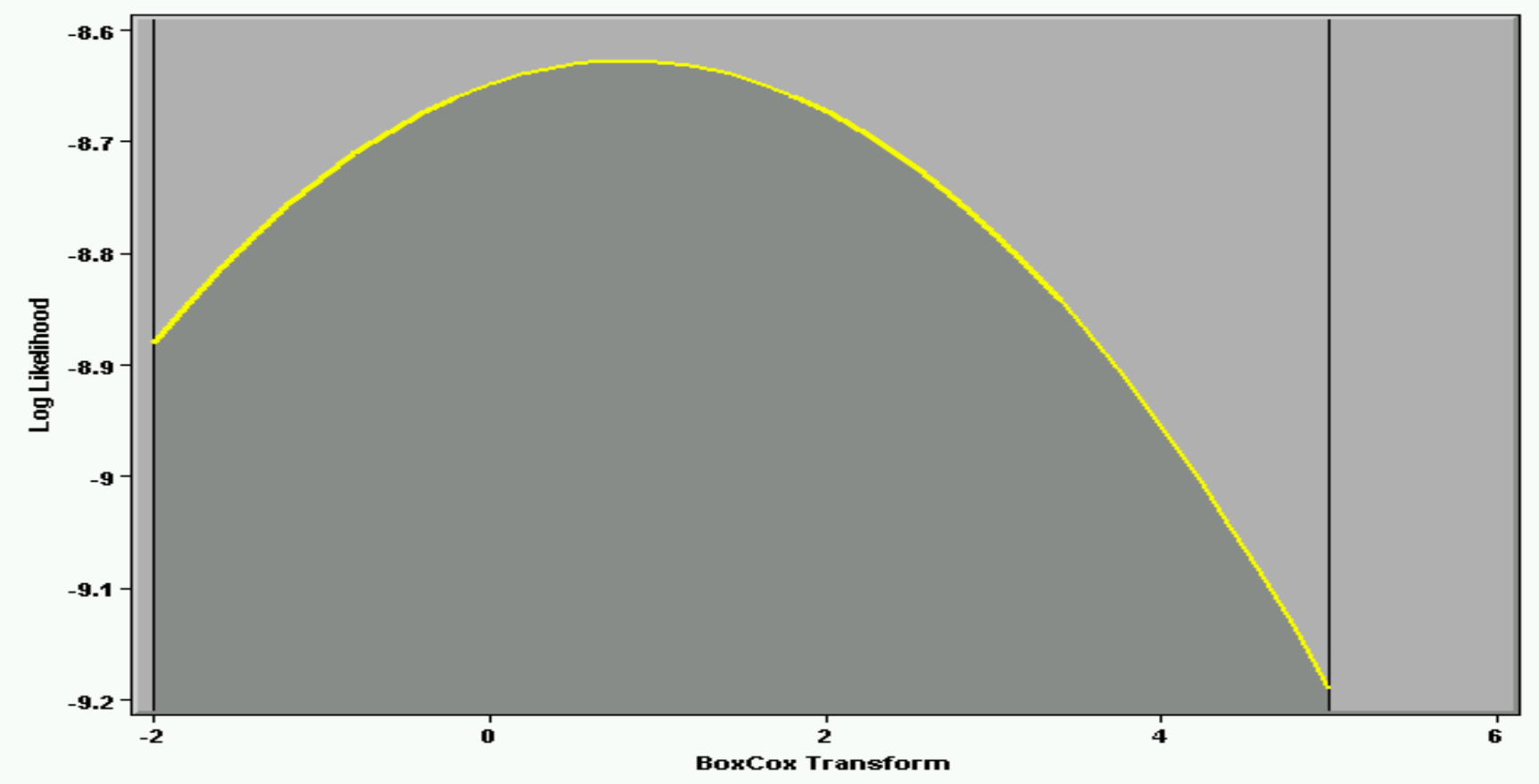
The transformation 1/%VisInc**0.2 is optimal for this range of powers but the transformation LN(%VisInc) is recommended because it is within the confidence interval around the optimal power.

WPD BoxCox Transformation



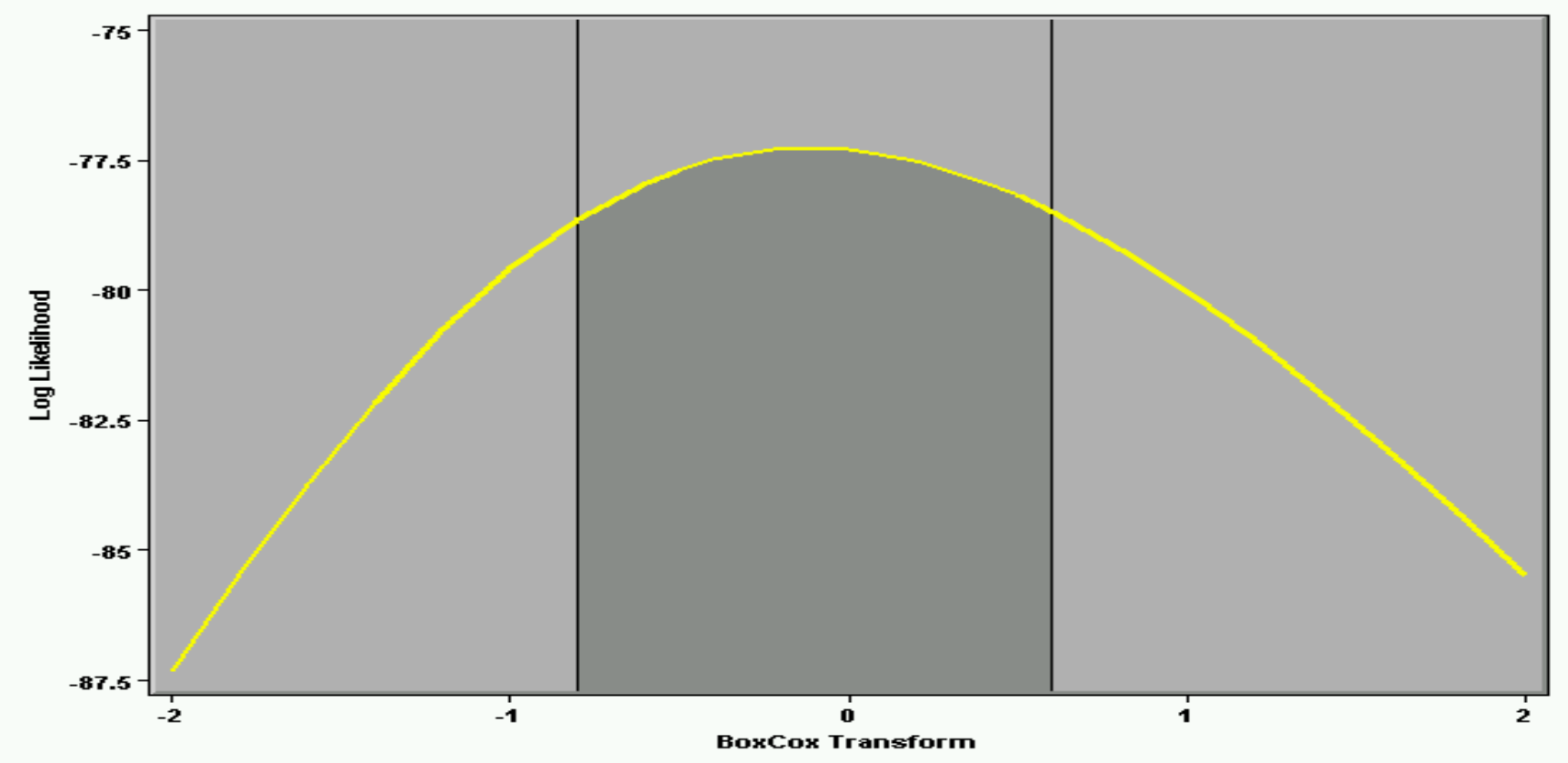
The transformation 1/WPD**1.6 is optimal for this range of powers but the transformation WPD is recommended because it is within the confidence interval around the optimal power.

APV BoxCox Transformation



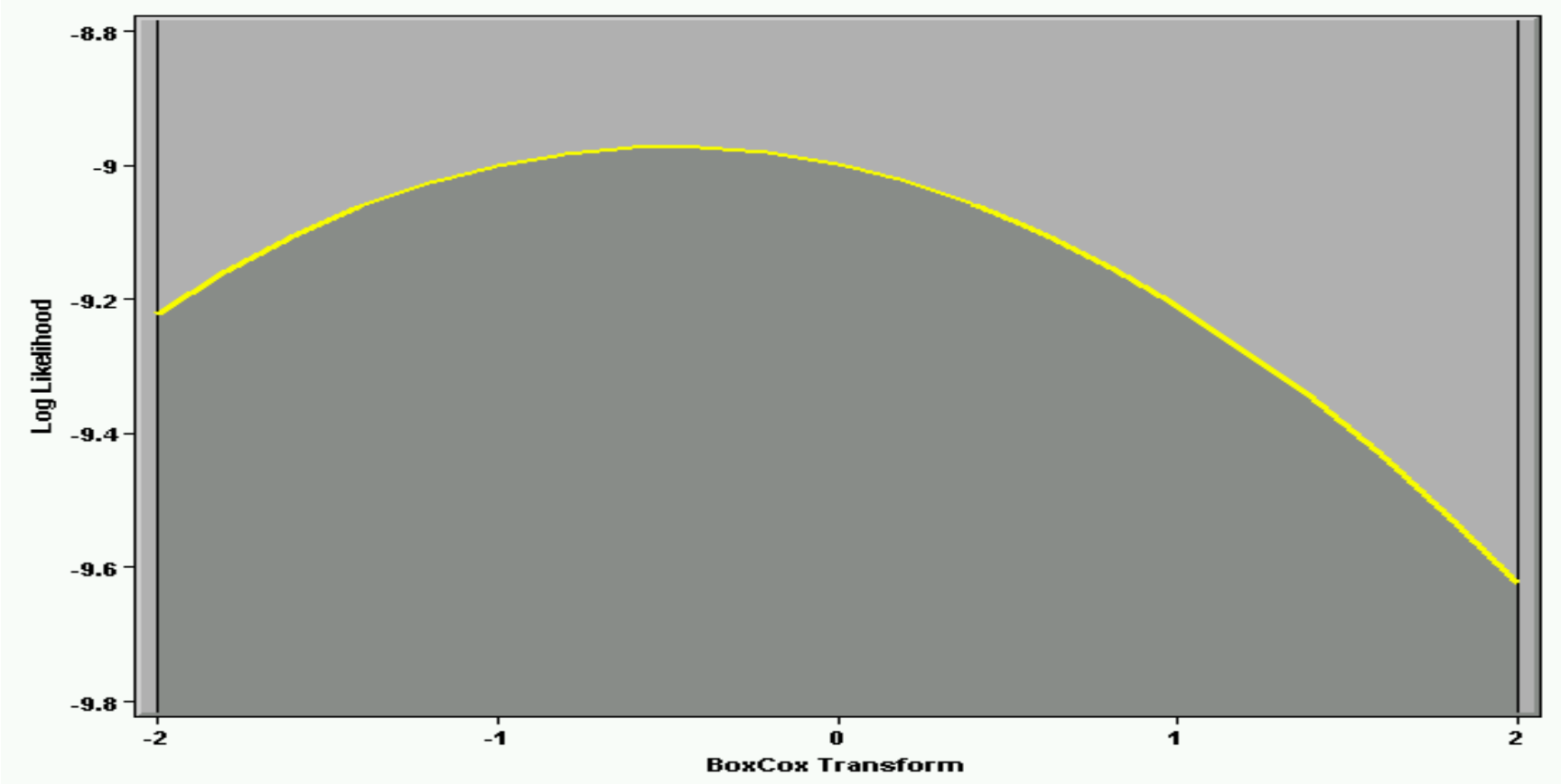
The transformation PSV**0.8 is optimal for this range of powers but the transformation PSV is recommended because it is within the confidence interval around the optimal power.

ACLW BoxCox Transformation



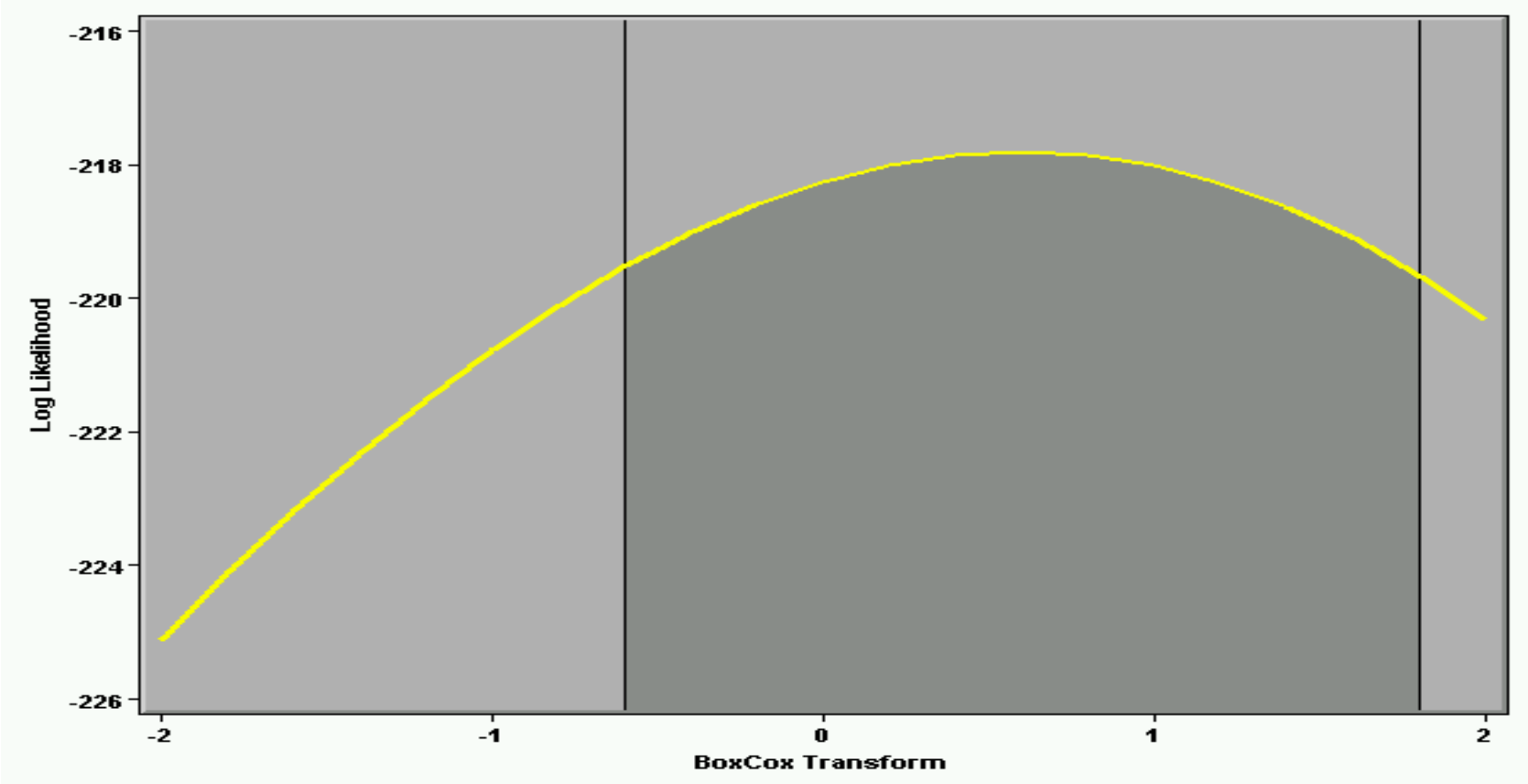
The transformation 1/ACLW**0.2 is optimal for this range of powers but the transformation LN(ACLW) is recommended because it is within the confidence interval around the optimal power.

Oil Consumption BoxCox Transformation



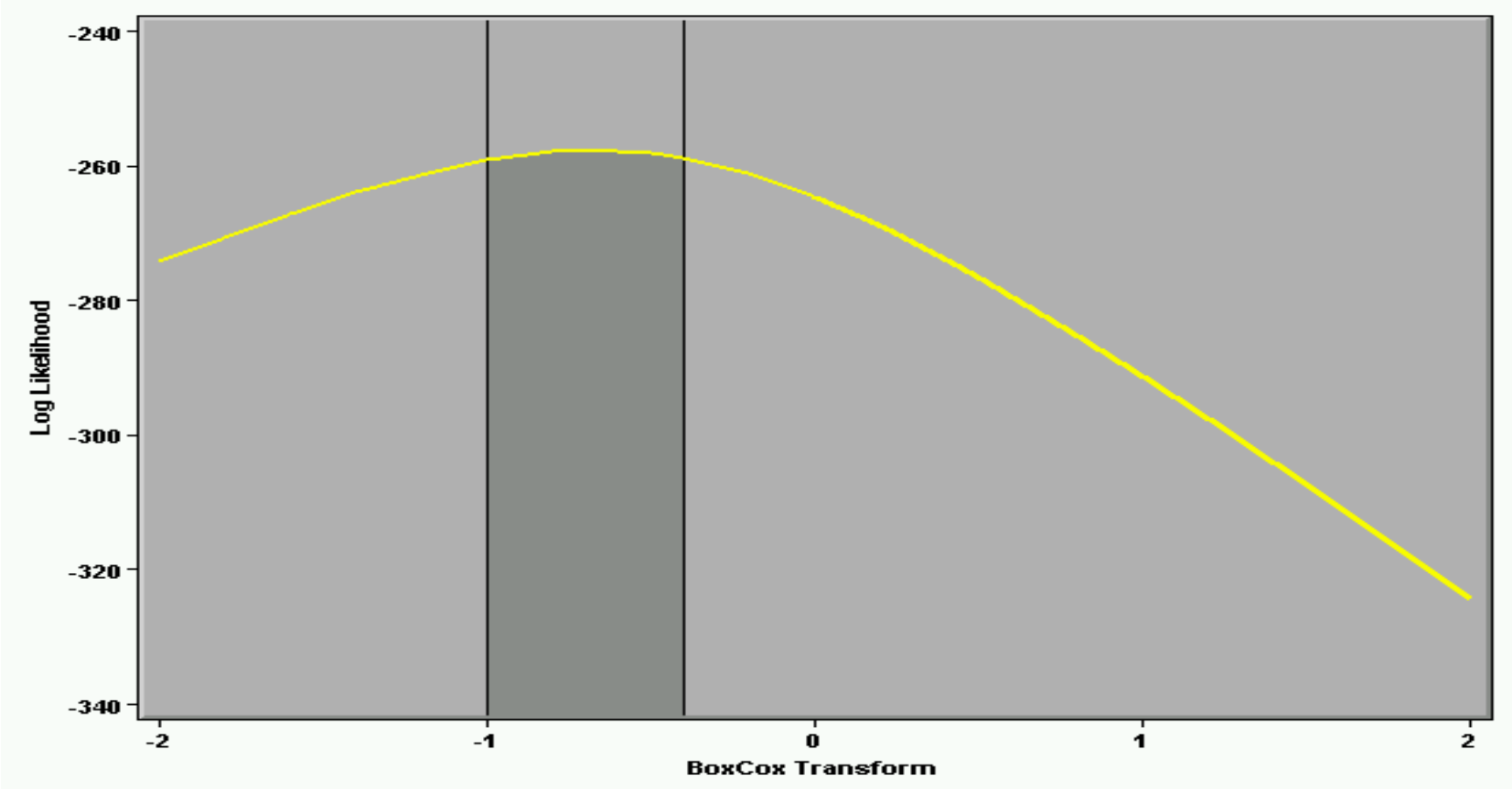
The transformation 1/sqrt(OilCon) is optimal for this range of powers but the transformation OilCon is recommended because it is within the confidence interval around the optimal power.

CCS BoxCox Transformation



The transformation CCS**0.6 is optimal for this range of powers but the transformation CCS is recommended because it is within the confidence interval around the optimal power.

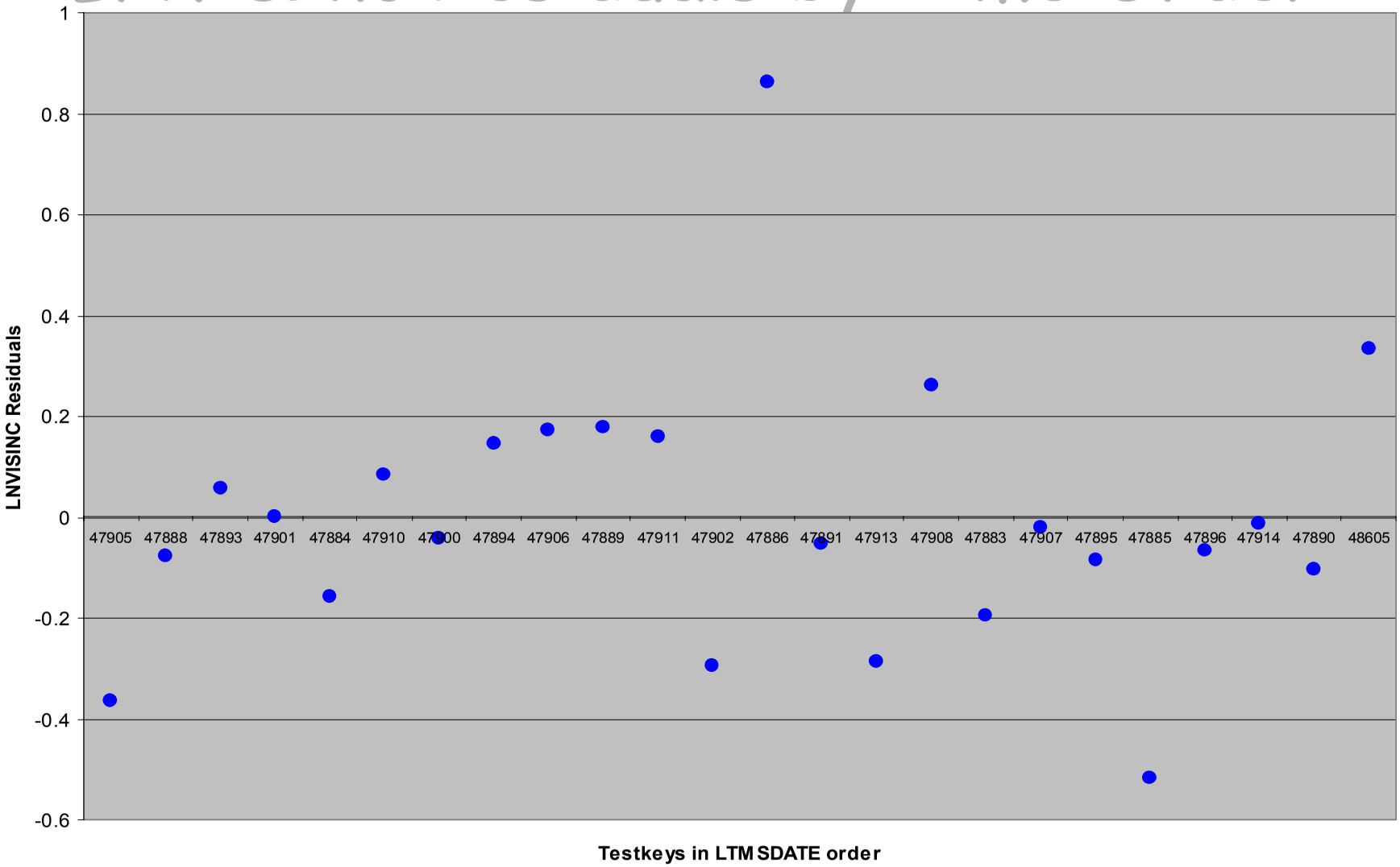
MRV BoxCox Transformation



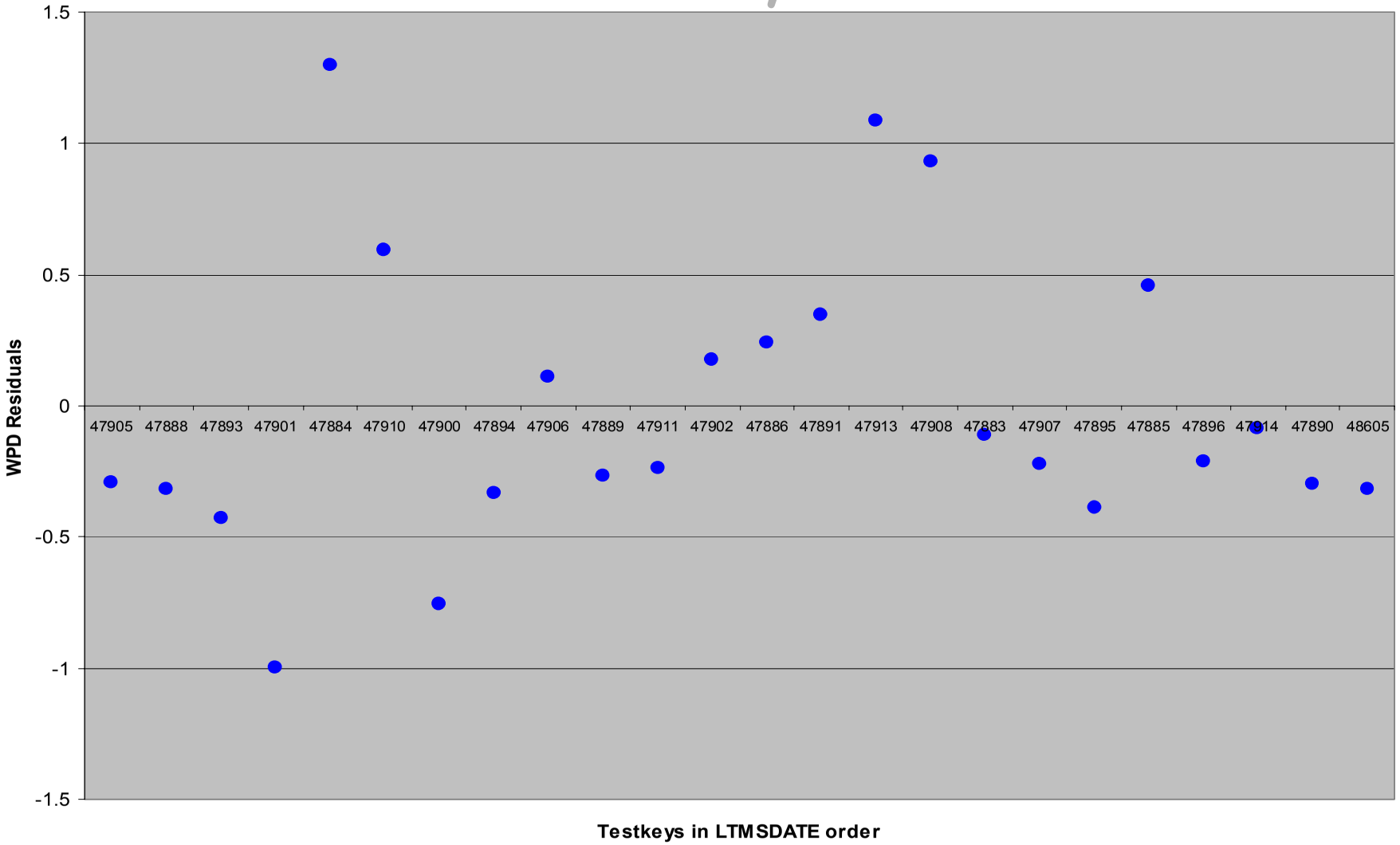
The transformation 1/MRV**0.6 is optimal for this range of powers but the transformation 1/sqrt(MRV) is recommended because it is within the confidence interval around the optimal power.

Residual Plots by Time Order

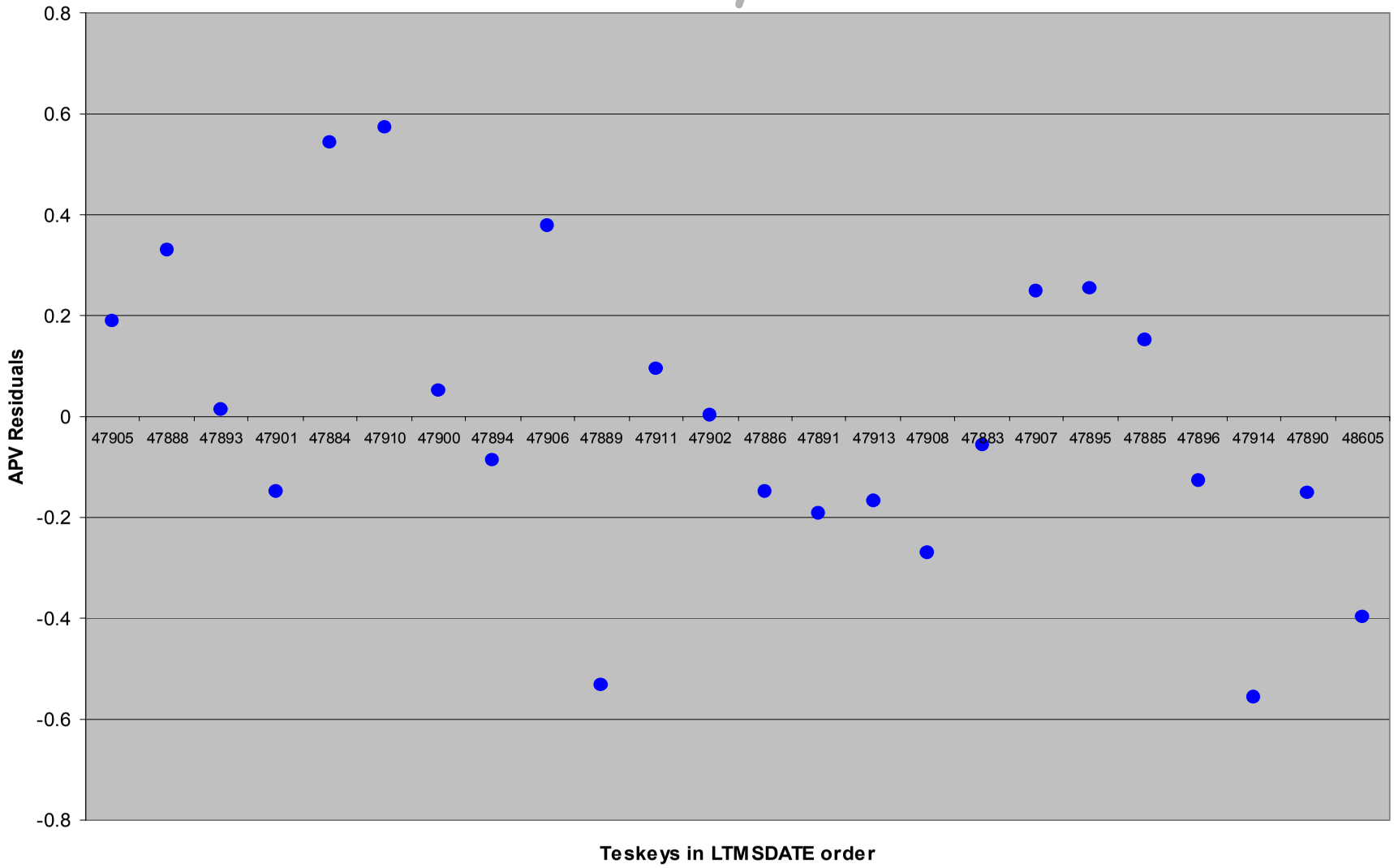
LNVisInc Residuals by Time Order



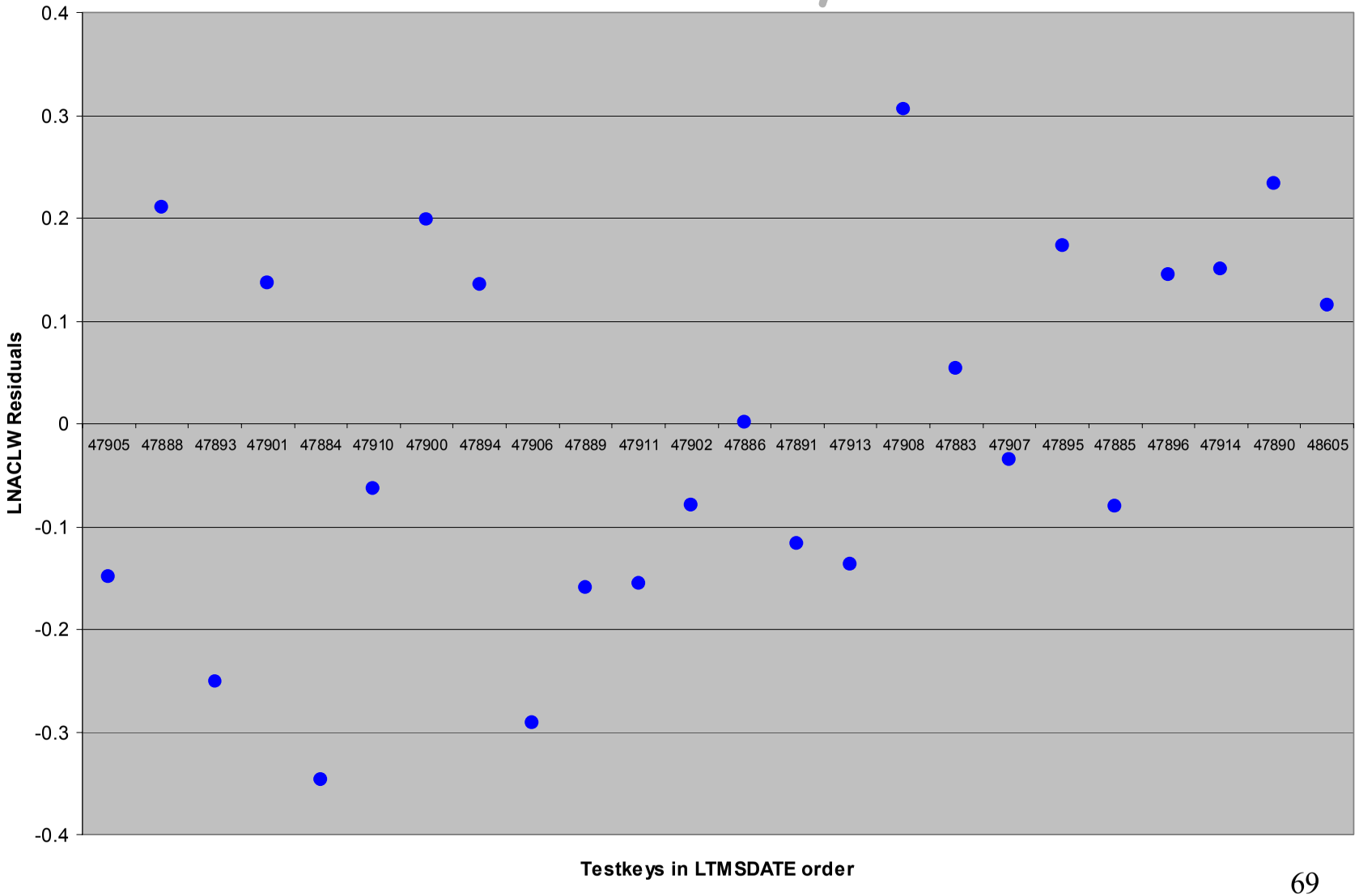
WPD Residuals by Time Order



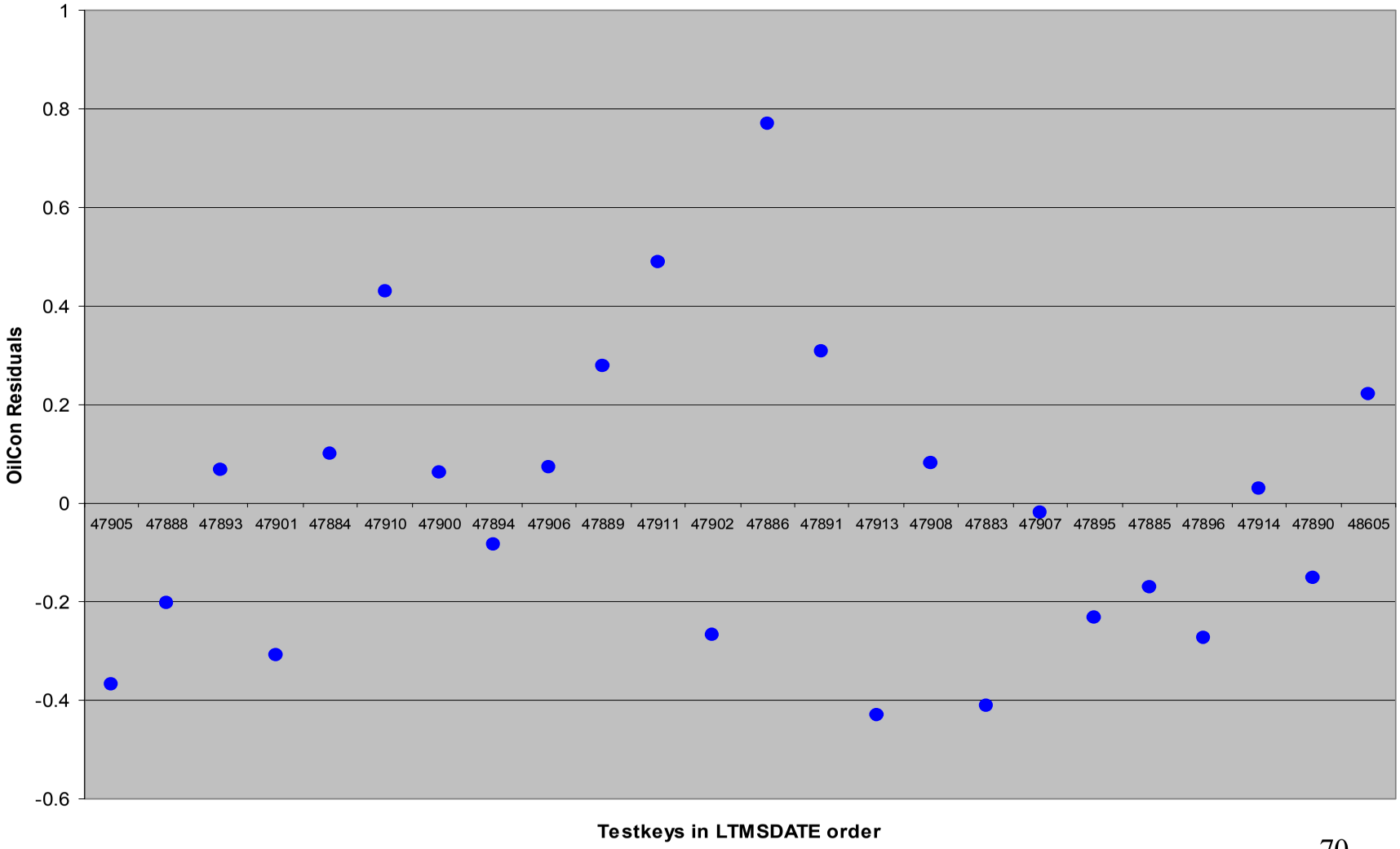
APV Residuals by Time Order



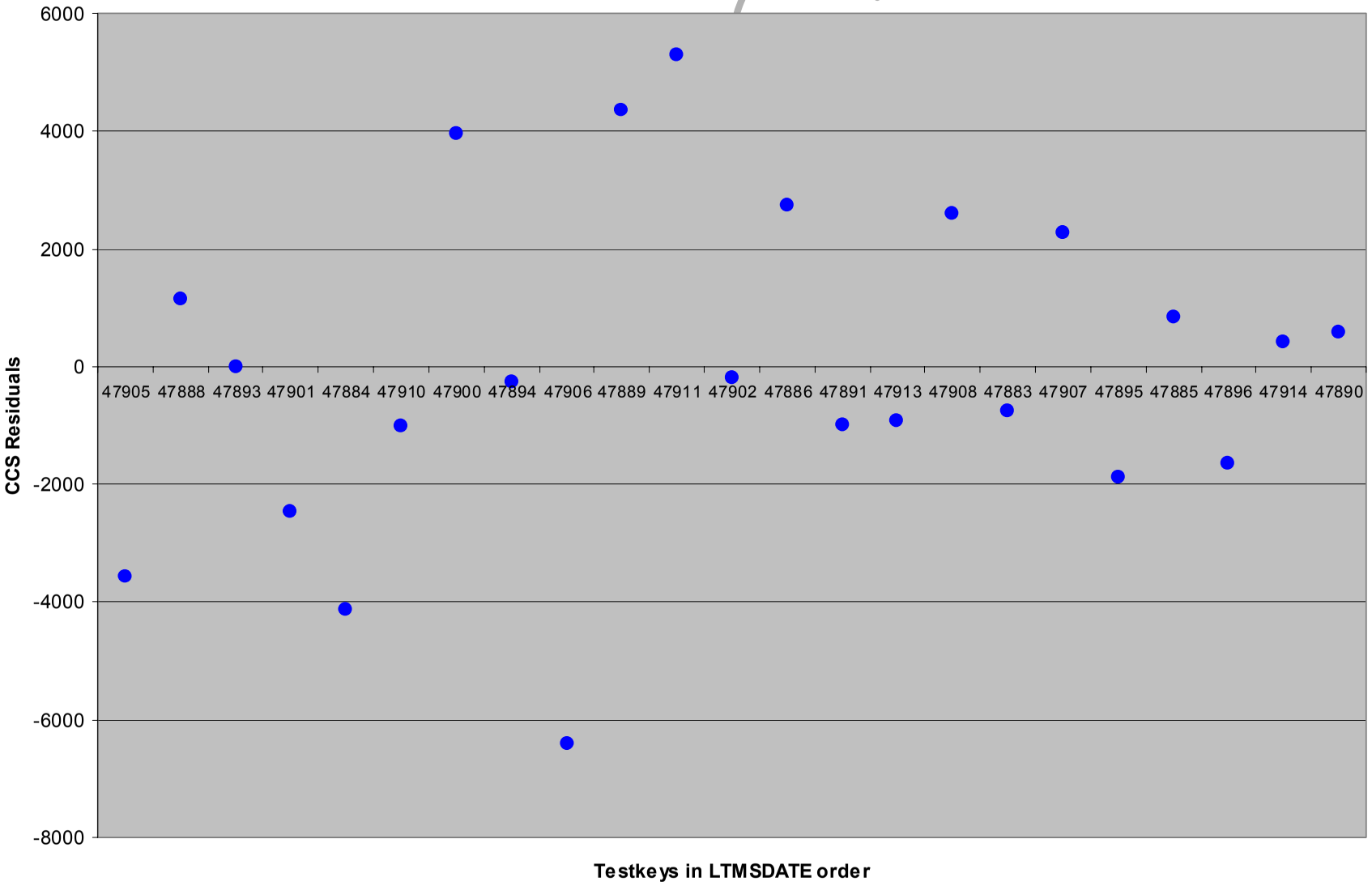
LNACLW Residuals by Time Order



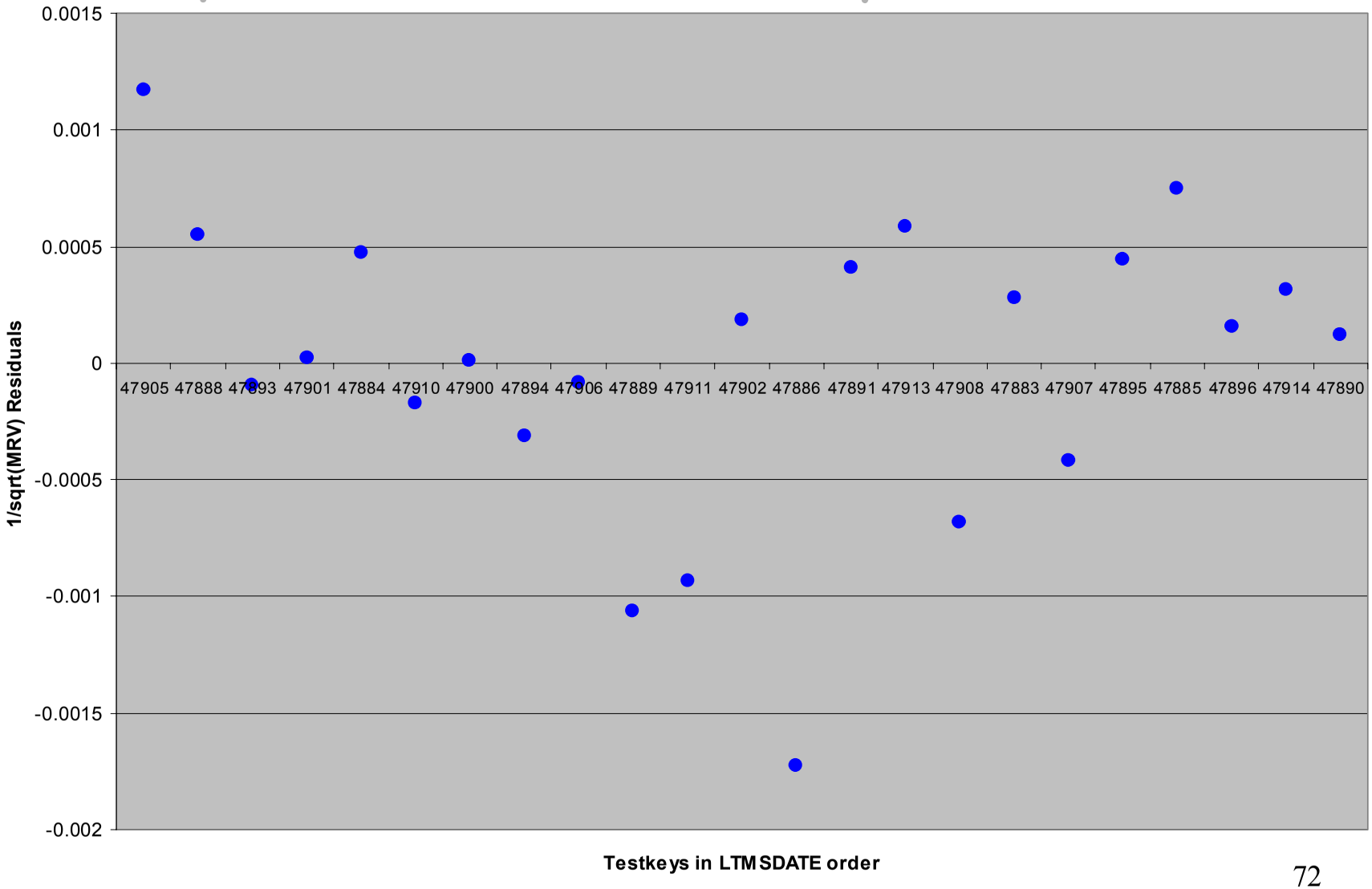
Oil Consumption Residuals by Time Order



CCS Residuals by Time Order



1/sqrt(MRV) Residuals by Time Order



Plots of the IIIG matrix data

Elisa Santos

June 5nd, 2003

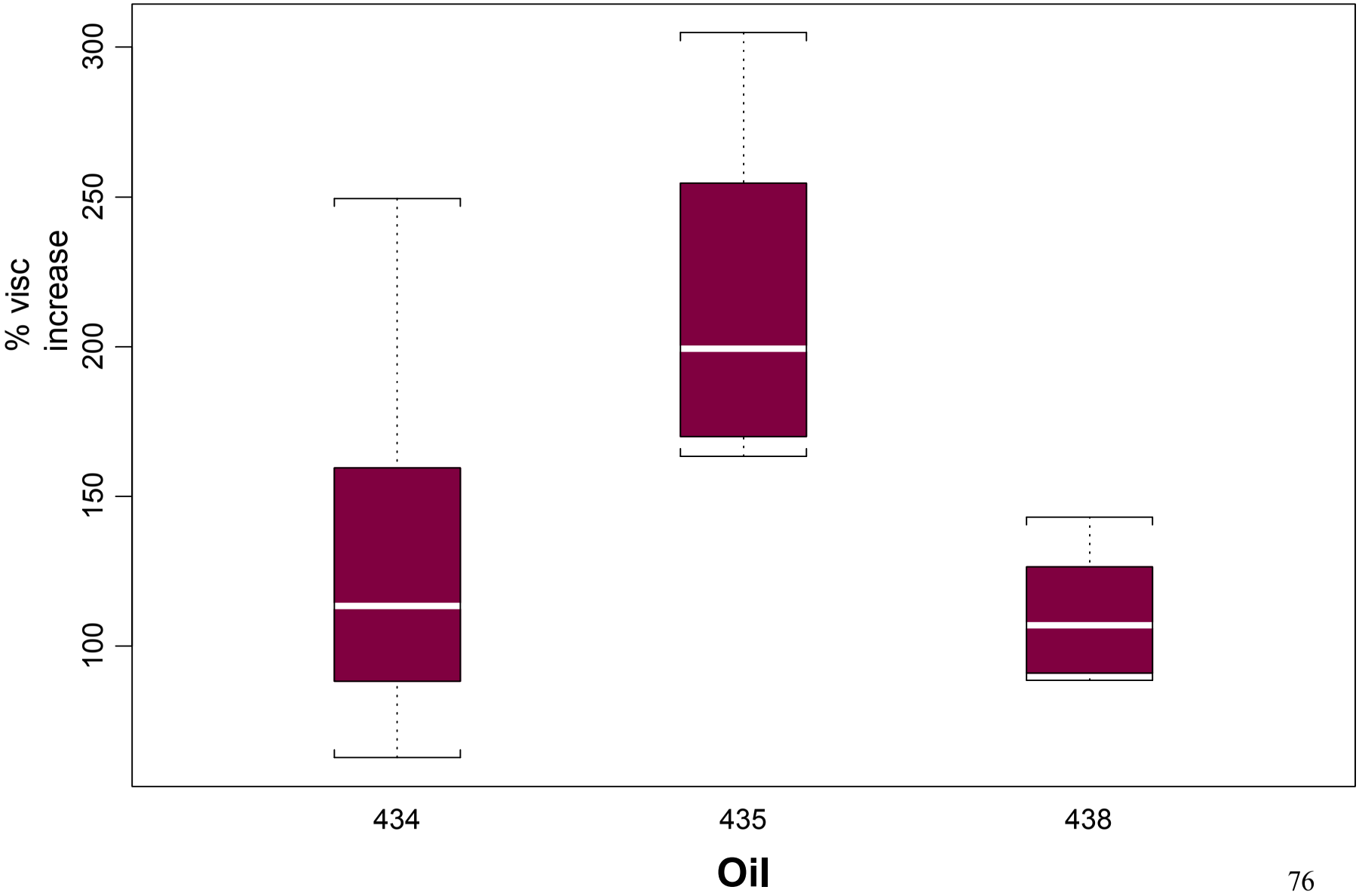
Data source

- 24 tests available June 4nd, 2003
- TMC site:

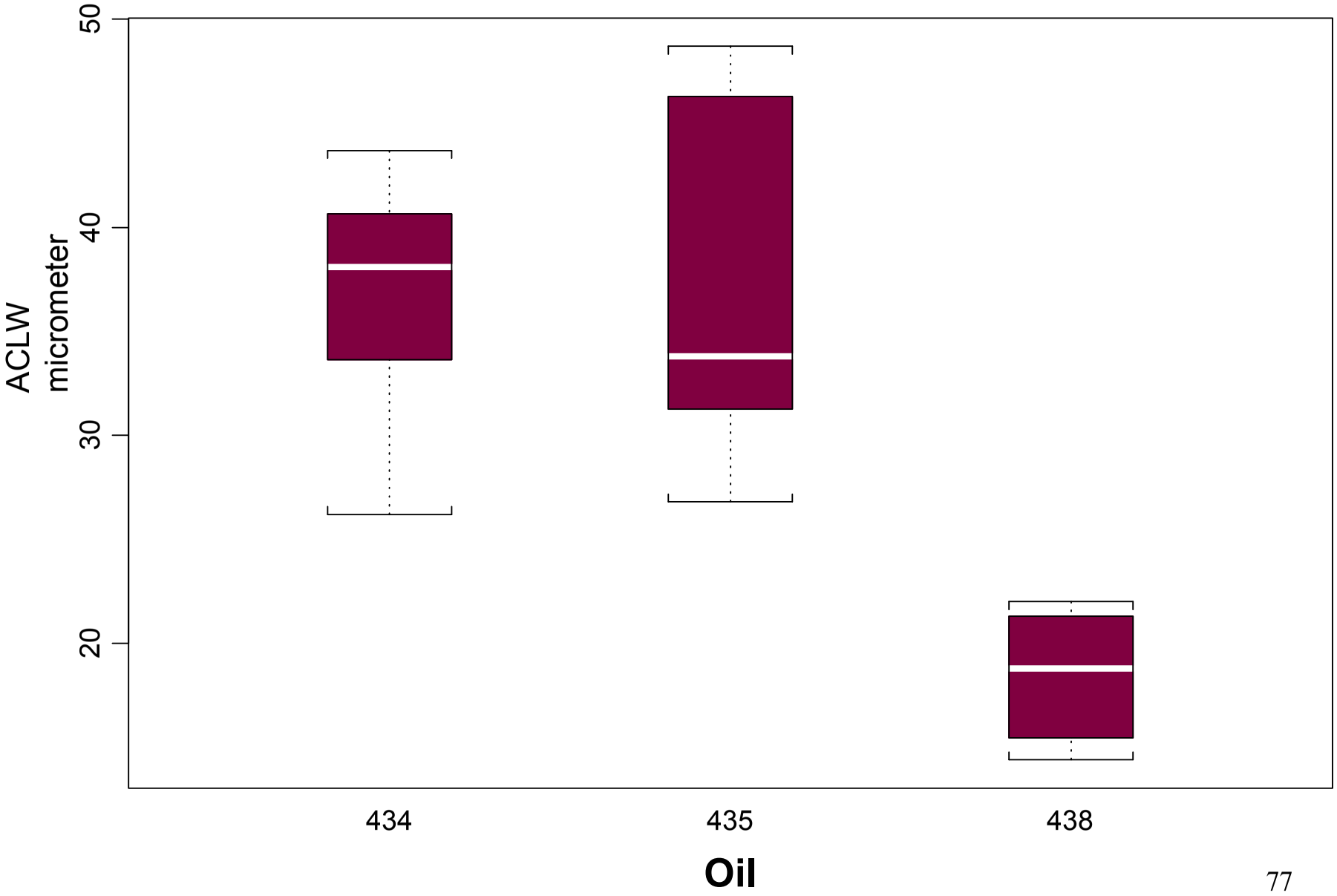
ftp://ftp.astmtmc.cmu.edu/refdata/gas/iiig/data/ltms.csv

Plots by oil

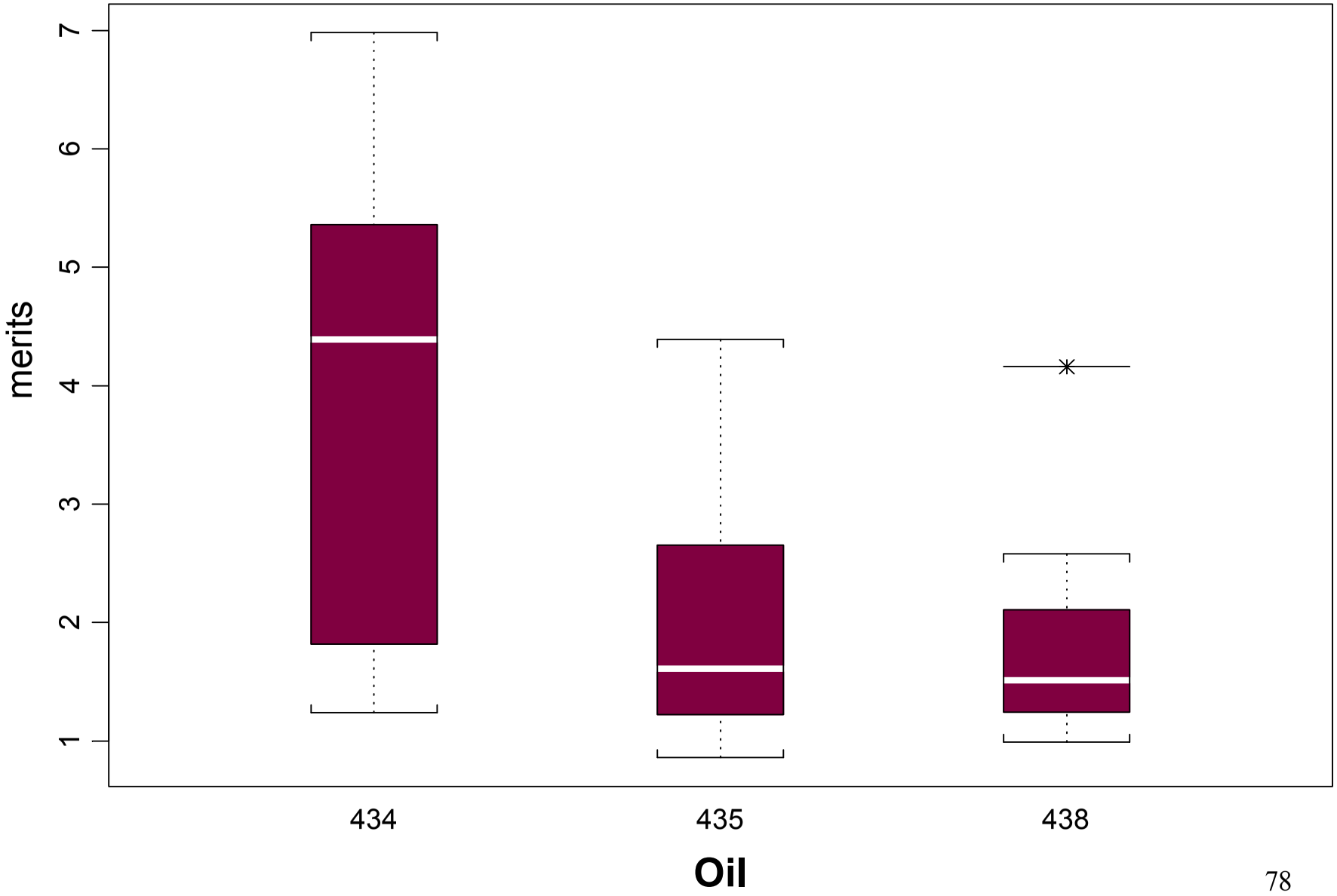
% Visc. Increase by Ref. Oil



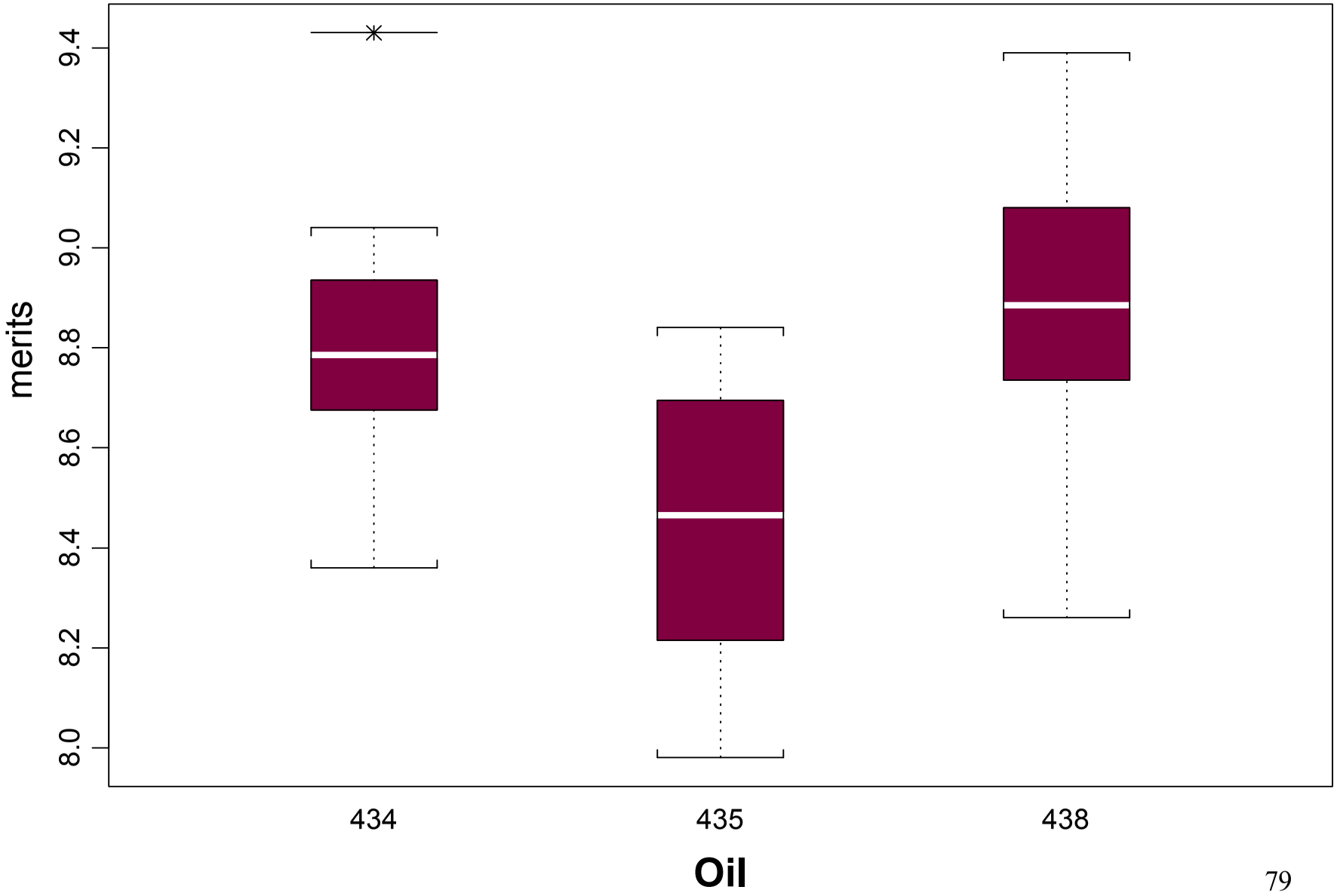
Average Cam Lifter Wear by Ref. Oil



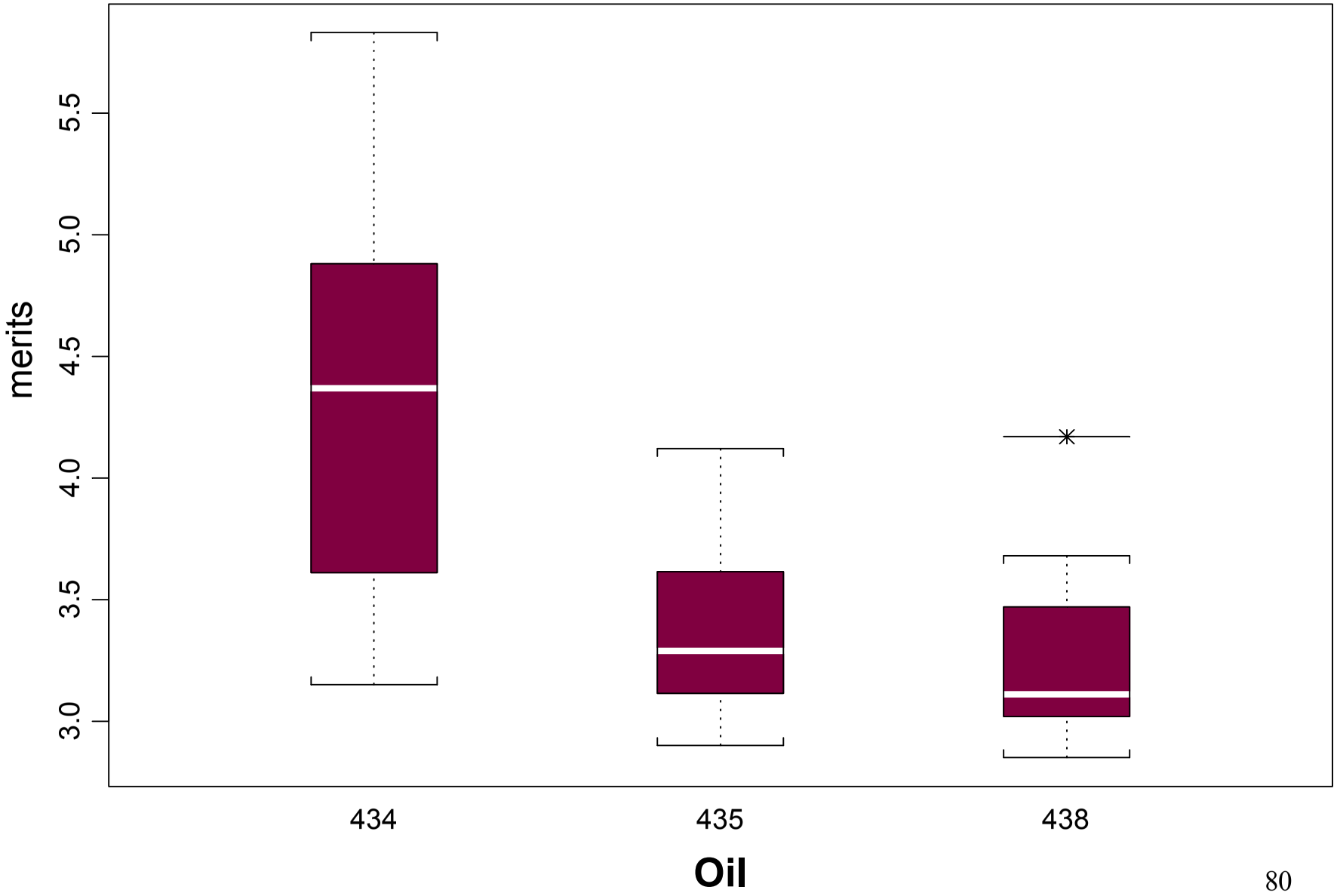
Oil Ring Land Deposits



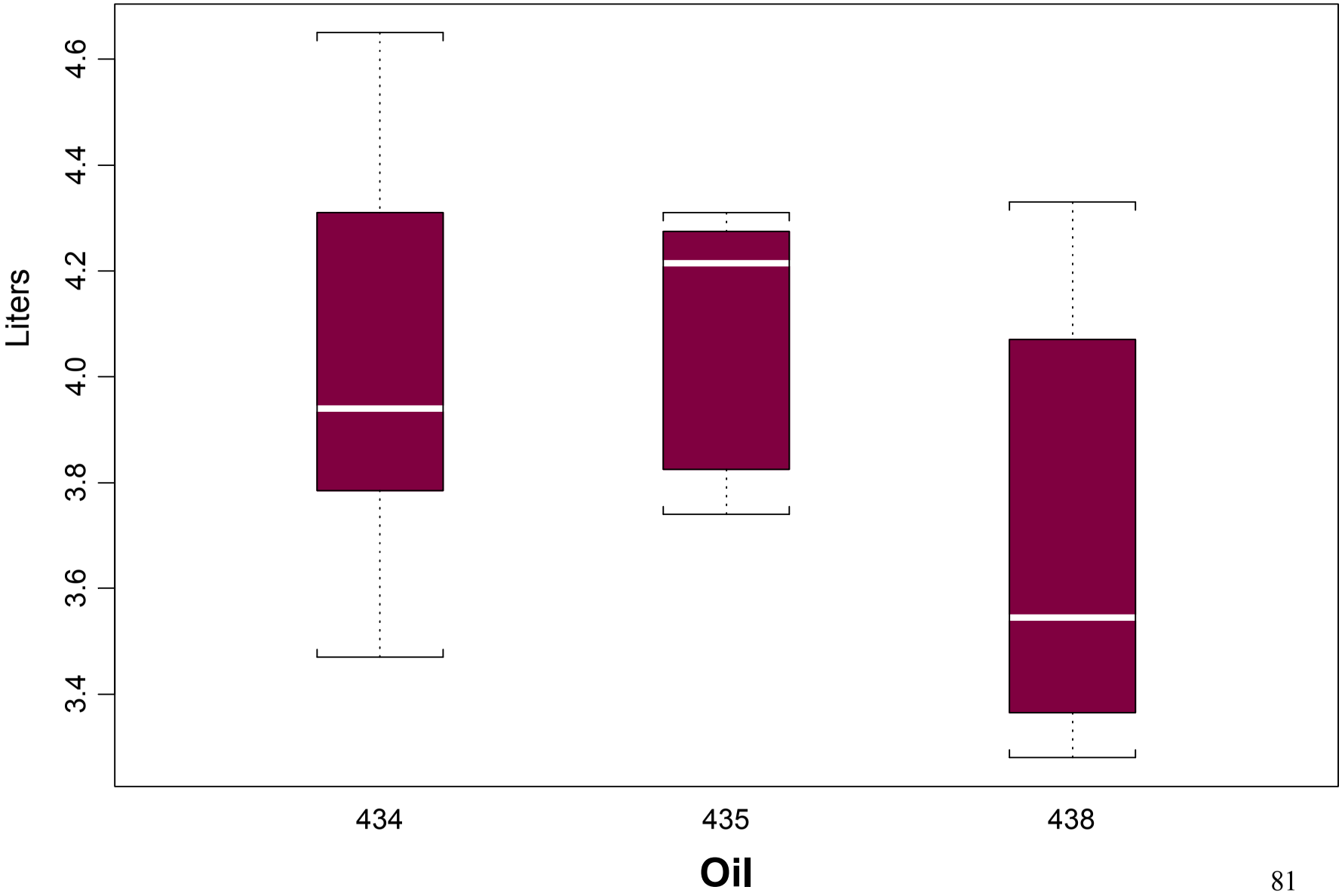
Average Piston Varnish by Ref. Oil



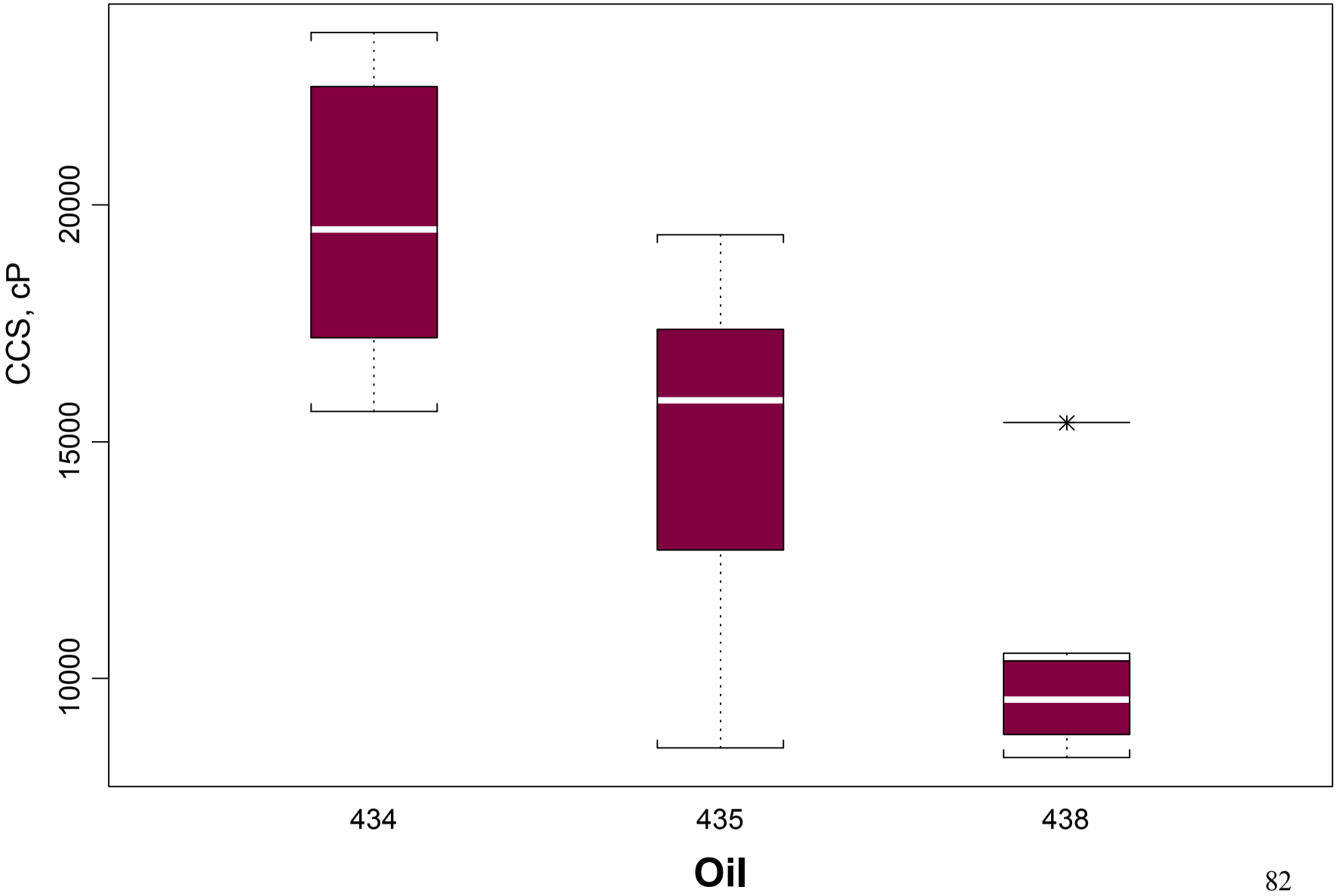
Weighted Piston Deposits by Ref. Oil



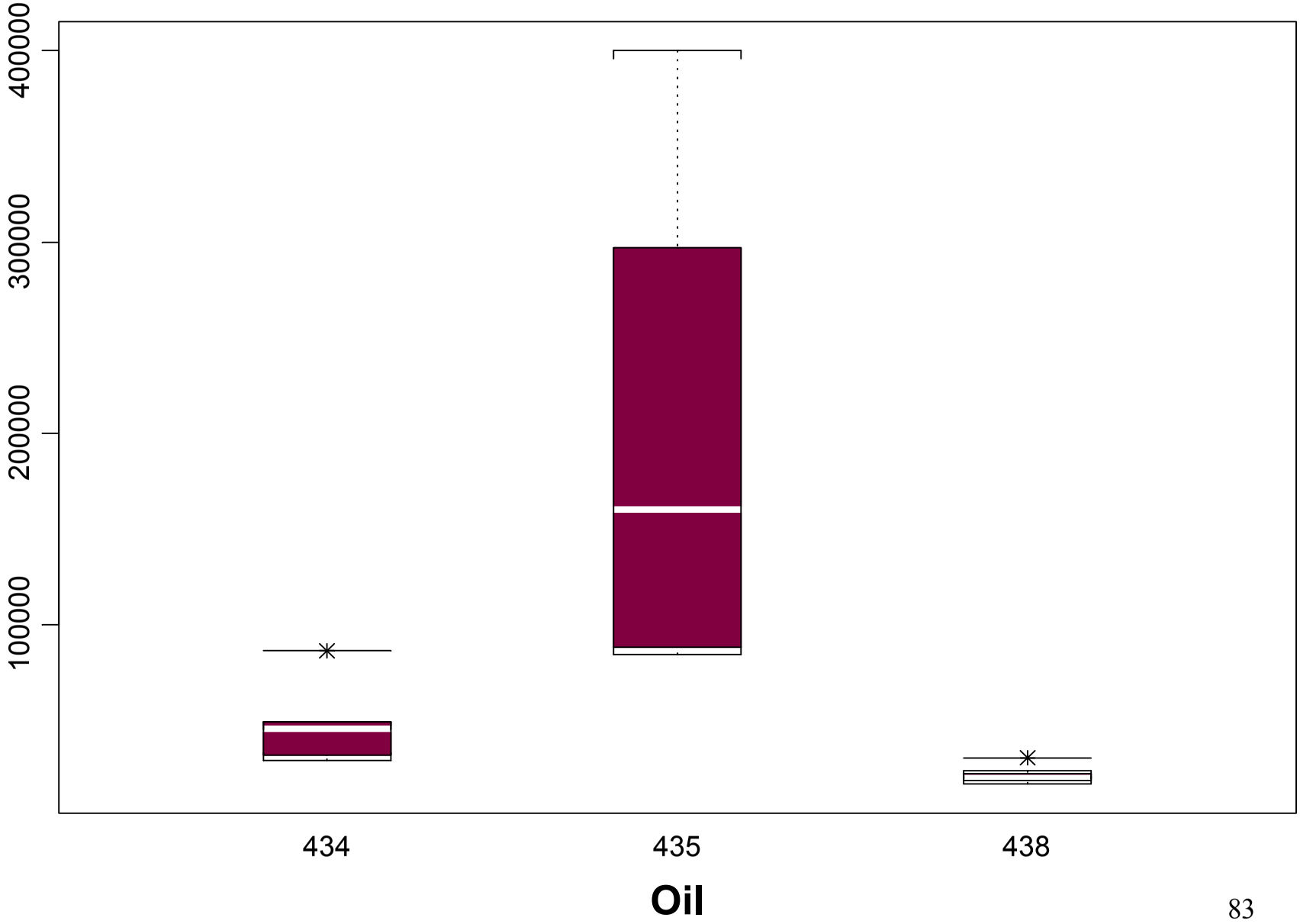
Oil Consumption by Ref. Oil



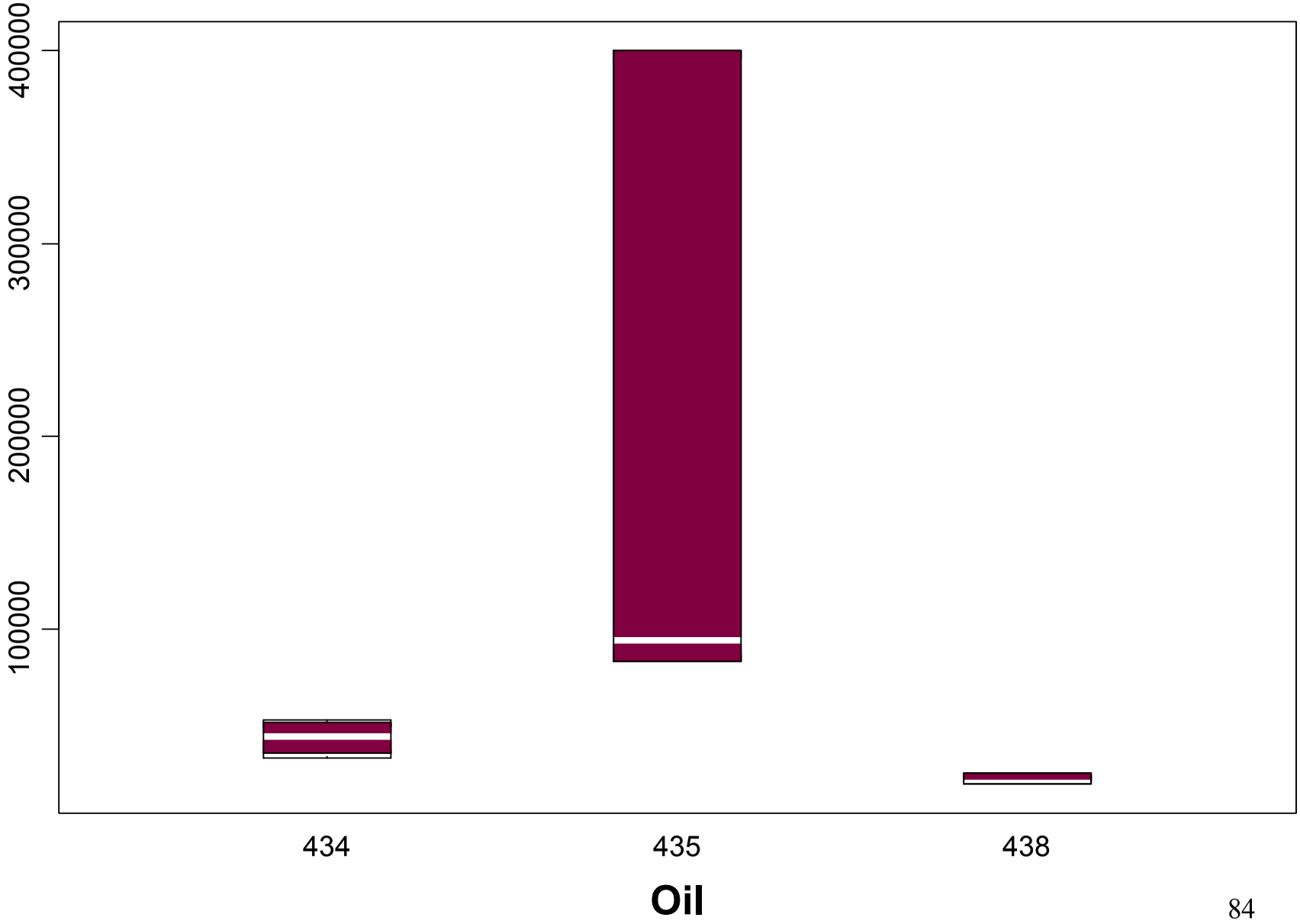
Cold Cranking by Ref. Oil



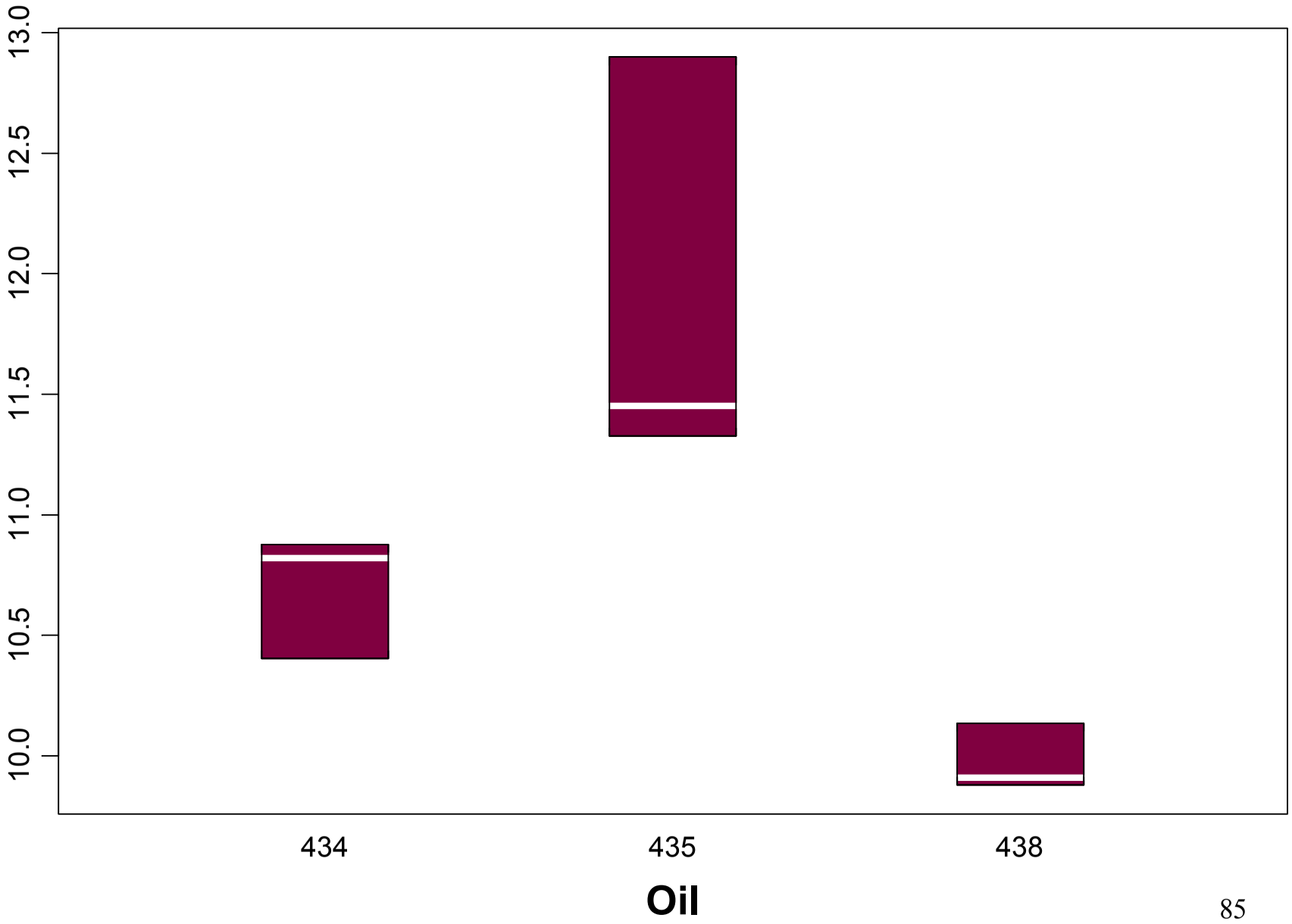
MRV @ end of test by Ref. Oil



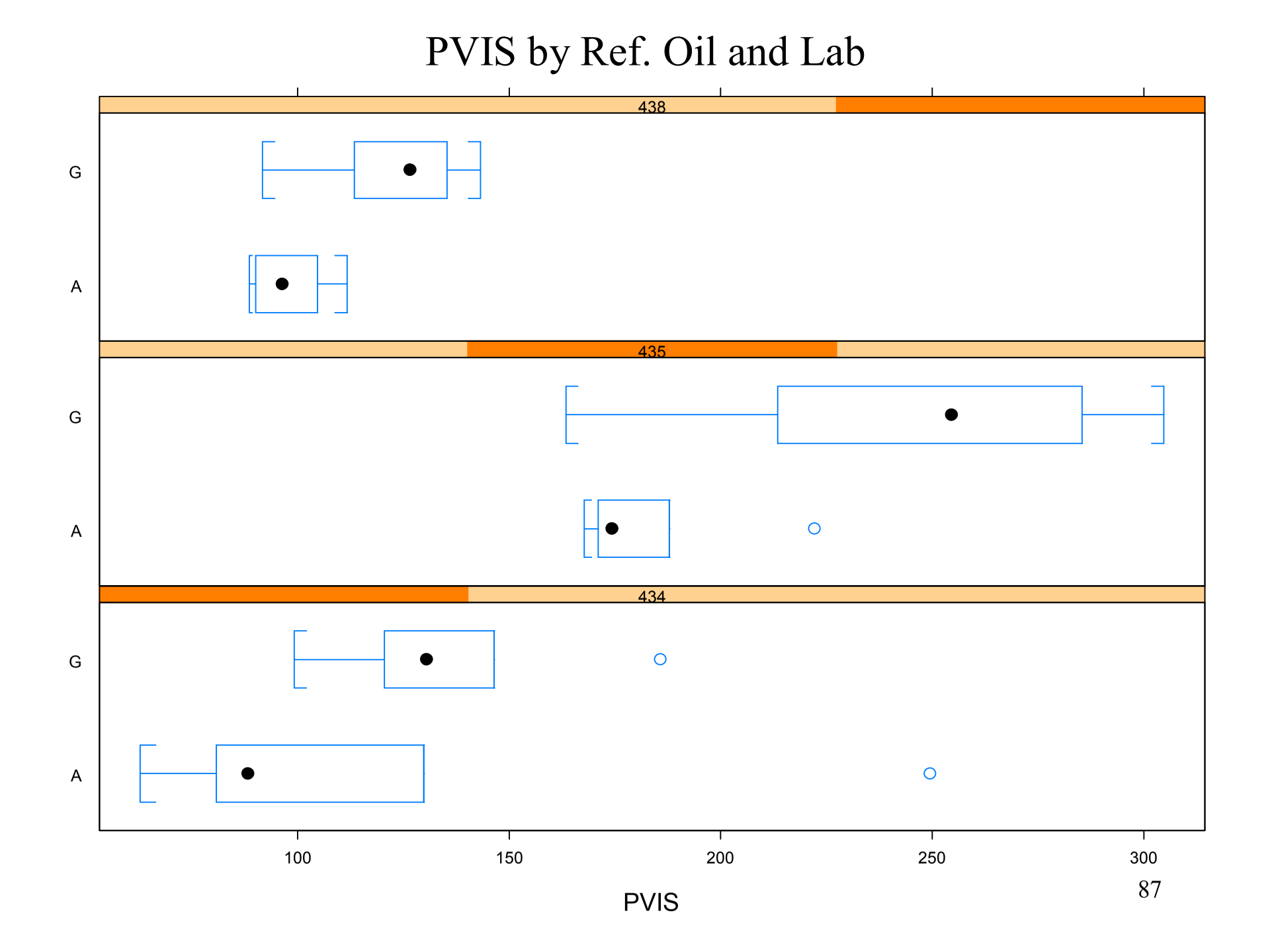
MRV @ end of test + 168 by Ref. Oil

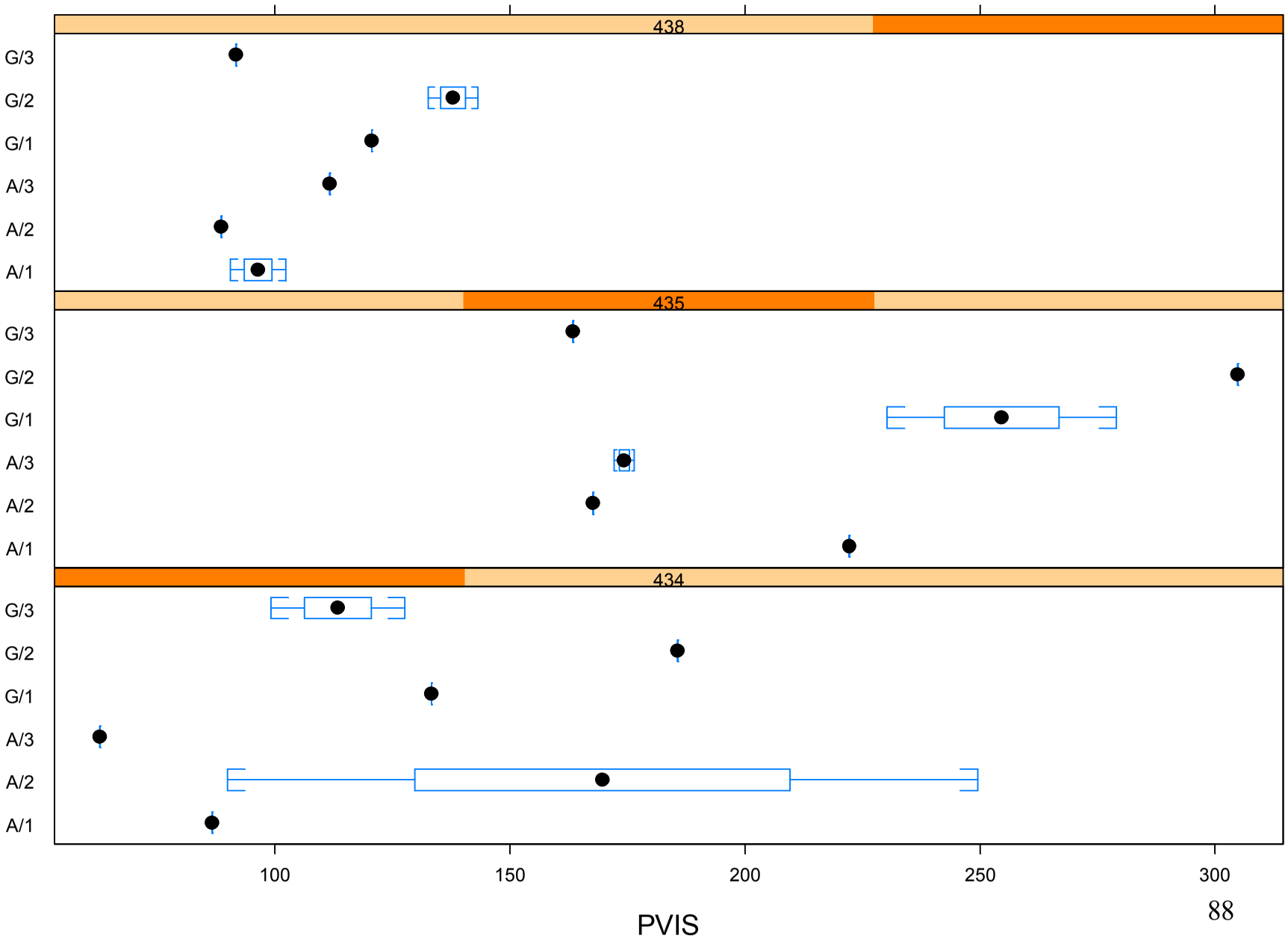


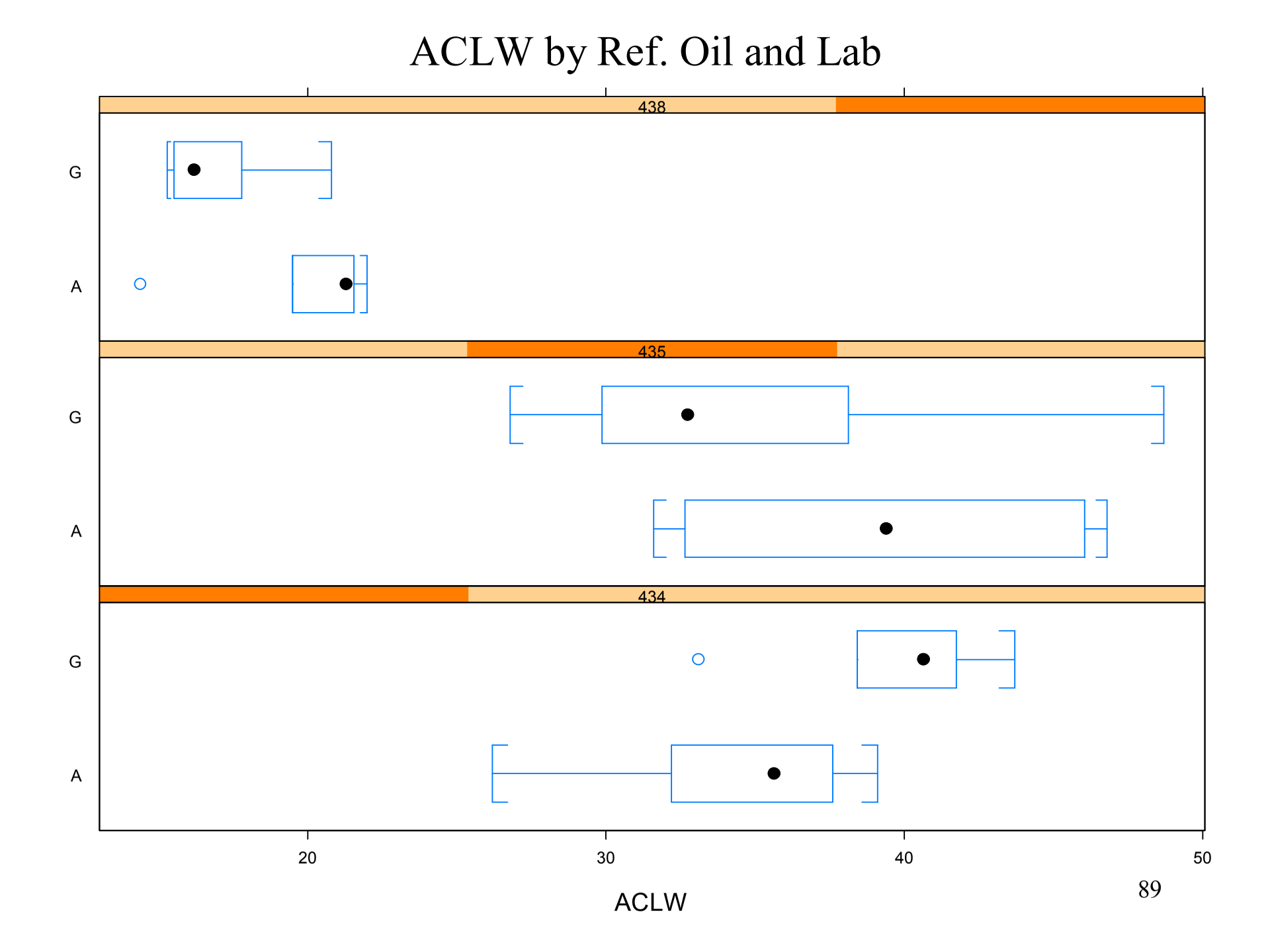
Log(MRV) @ end of test + 168 by Ref. Oil

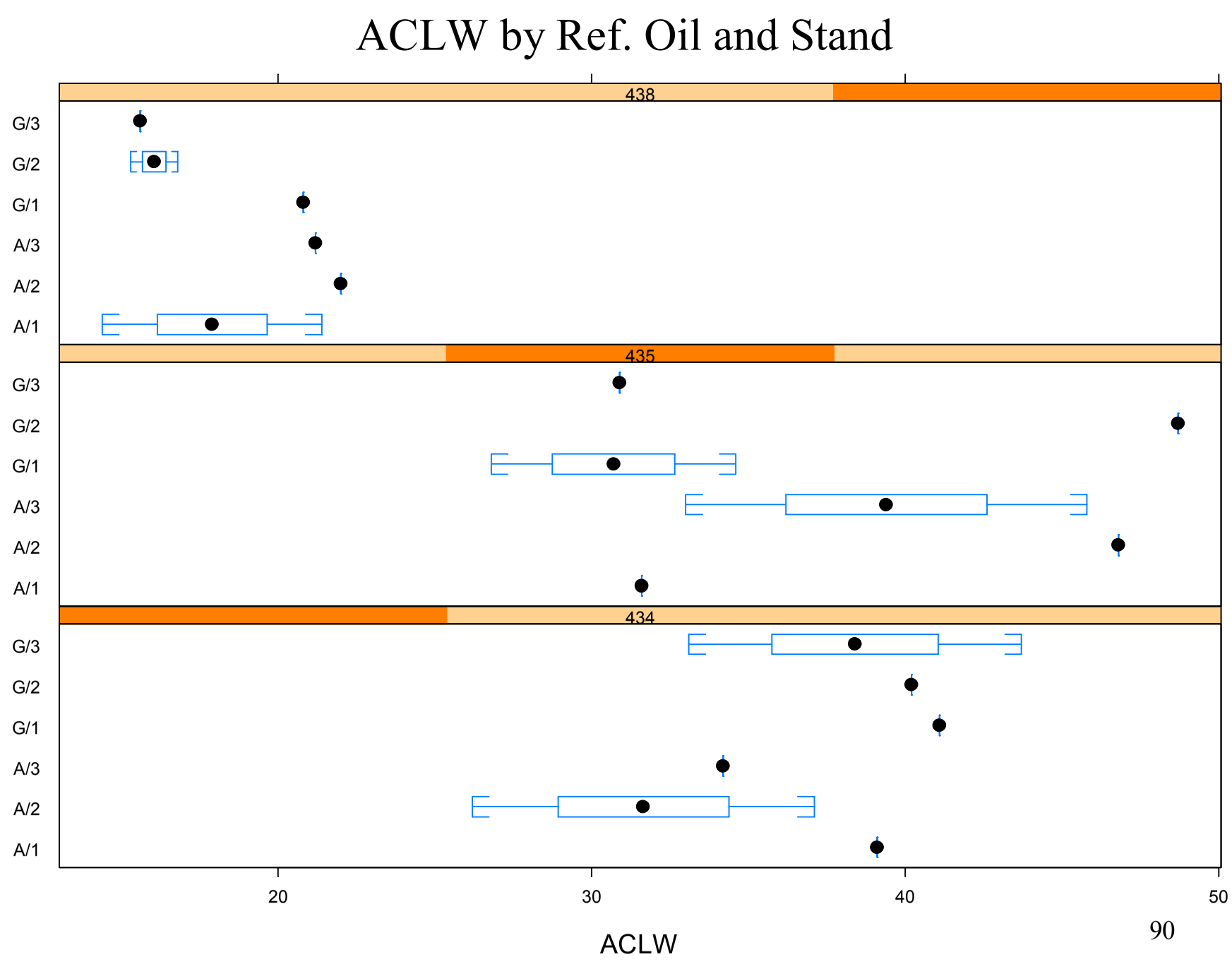


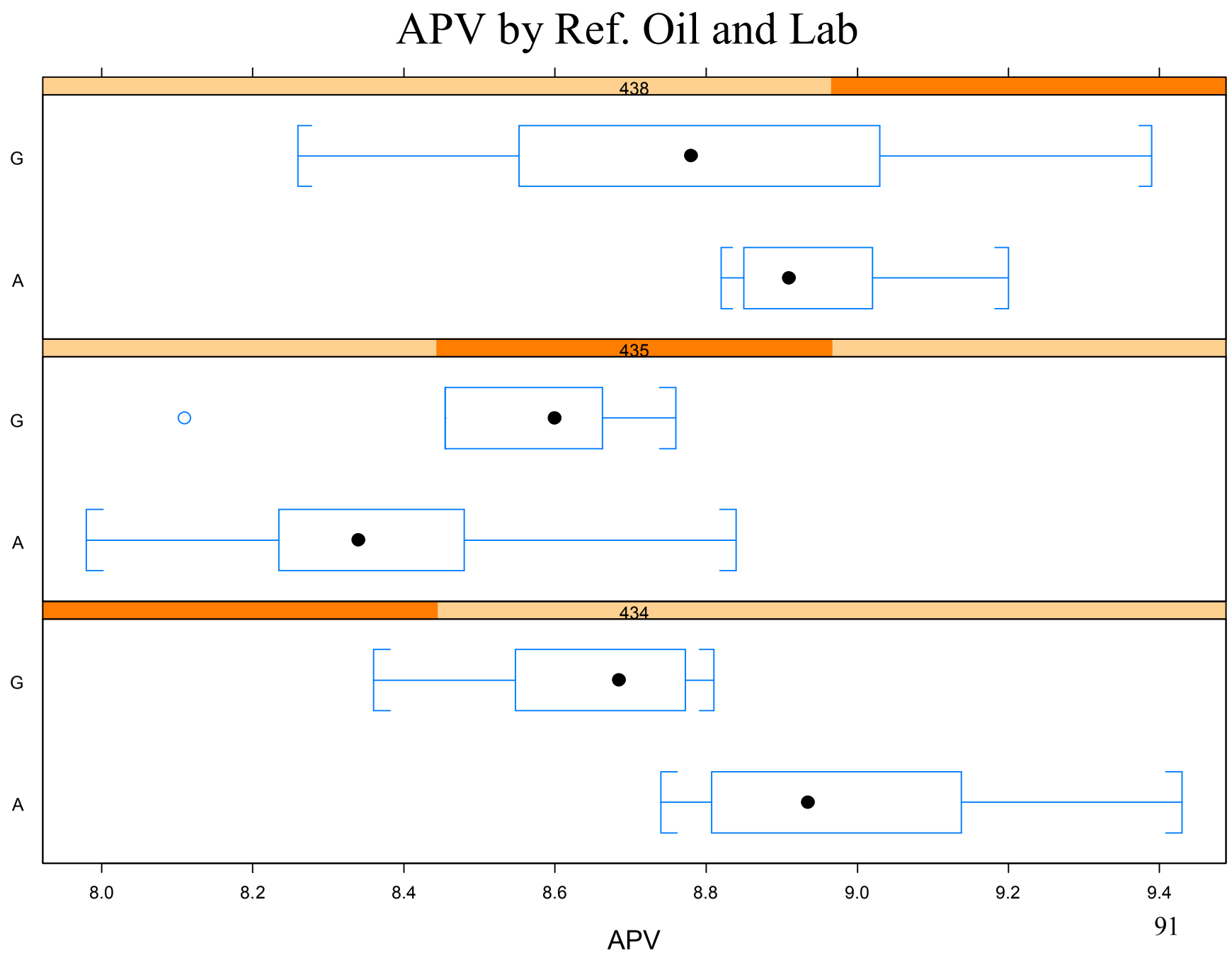
Additional plots by oil & lab and oil & stand, for each parameter

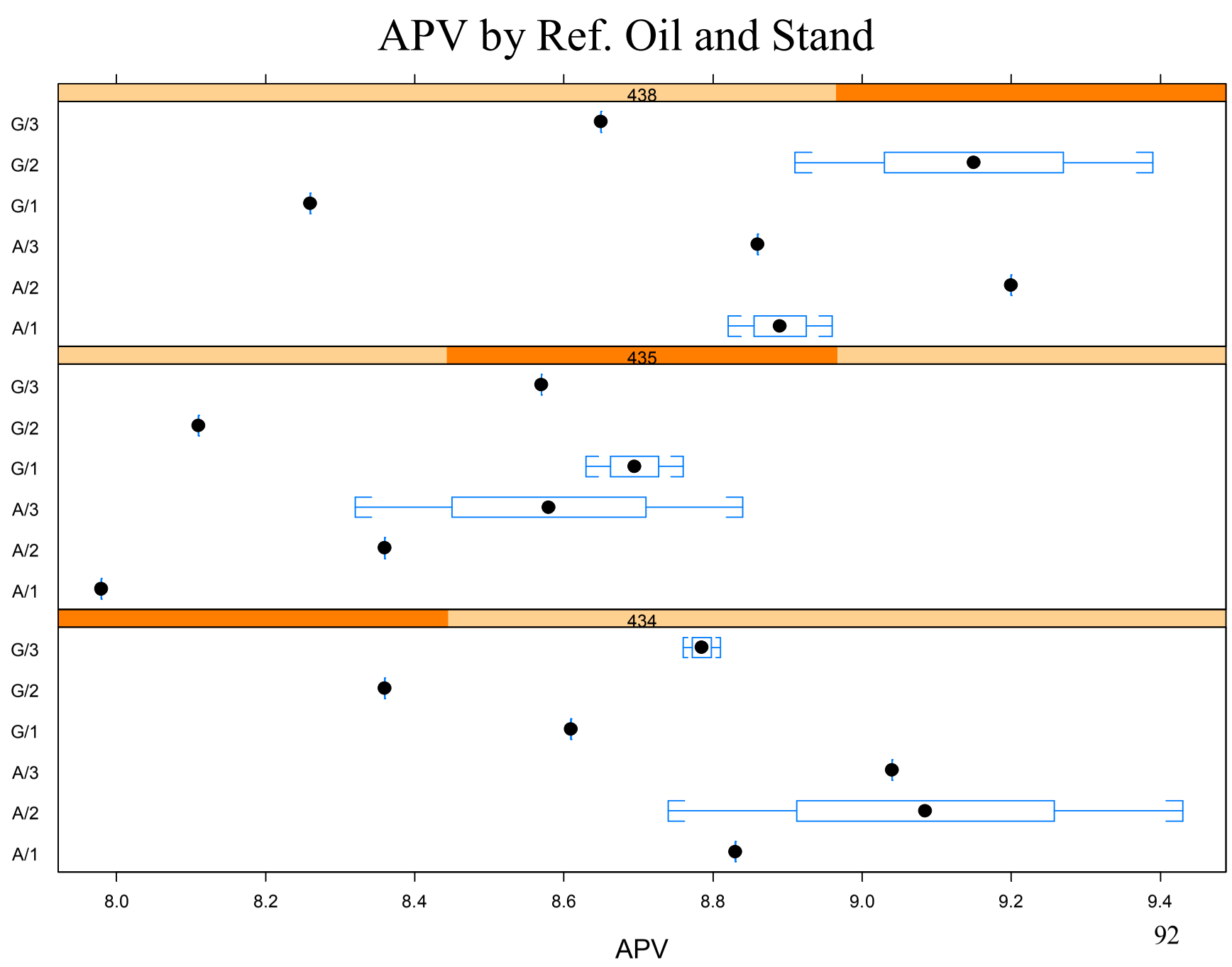

PVIS by Ref. Oil and Lab
438
435
434
G
A
G
A
G
A
100
150
200
250
300
PVIS

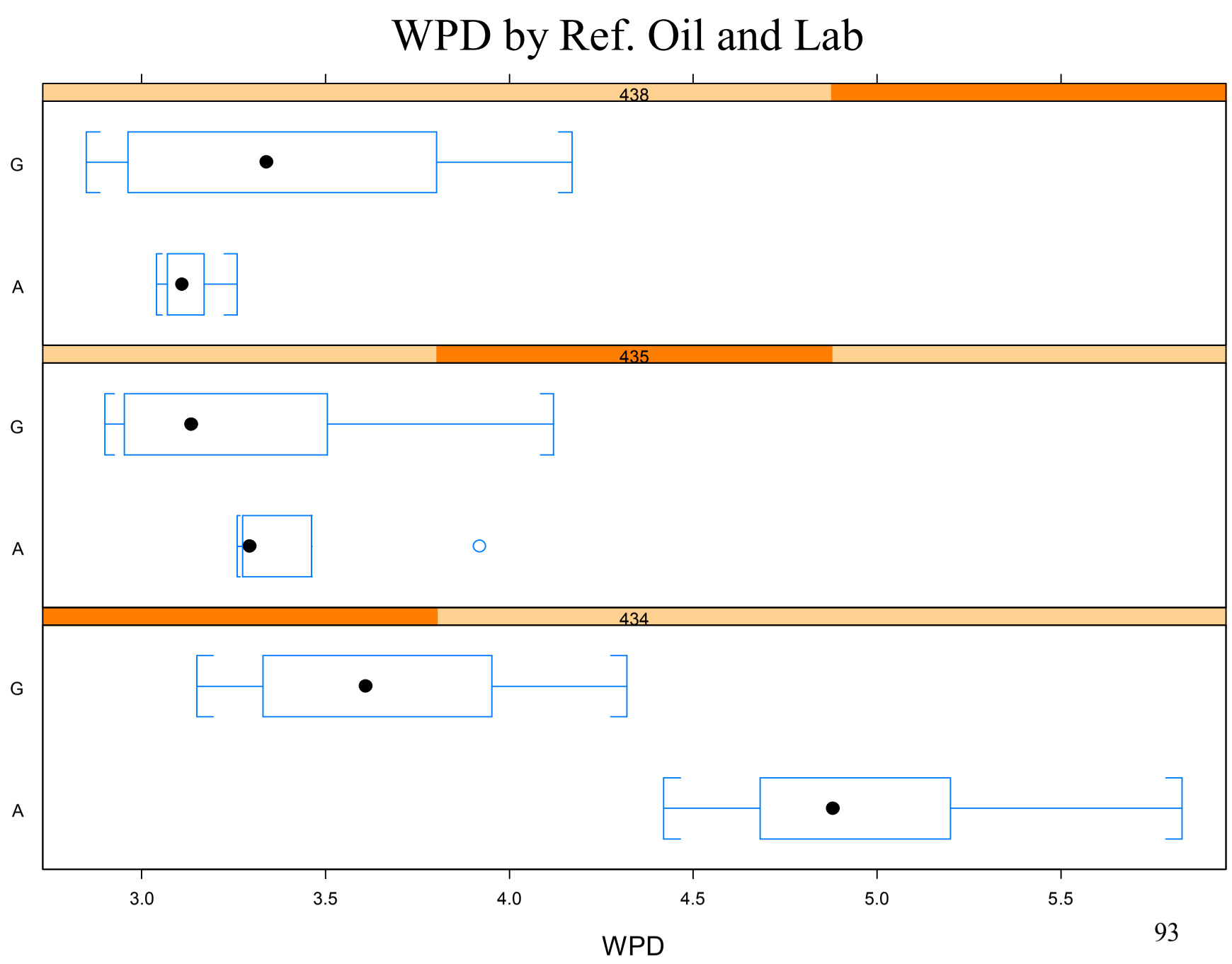

PVIS by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
100
150
200
250
300
PVIS

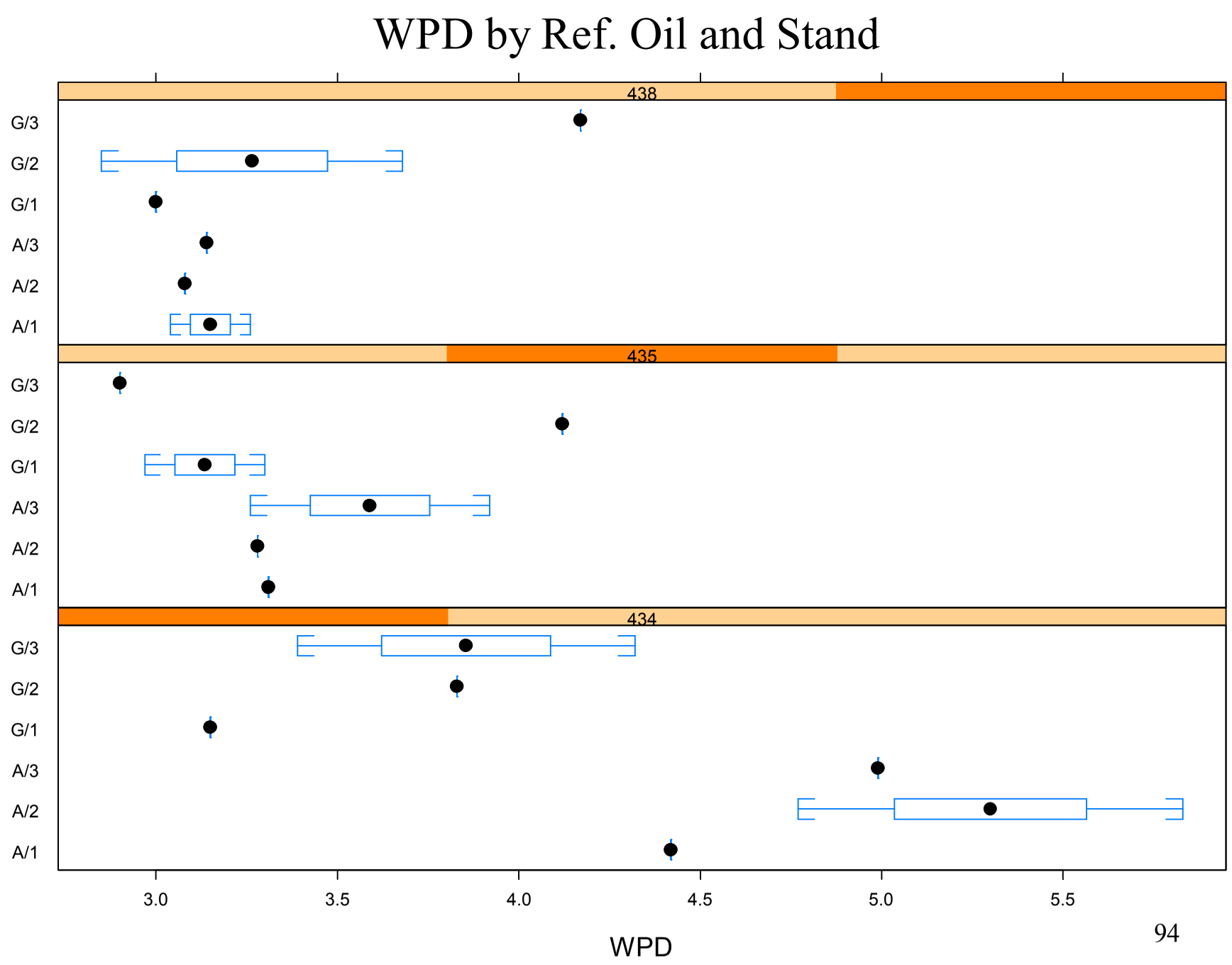

ACLW by Ref. Oil and Lab
438
435
434
G
A
20
30
40
50
ACLW

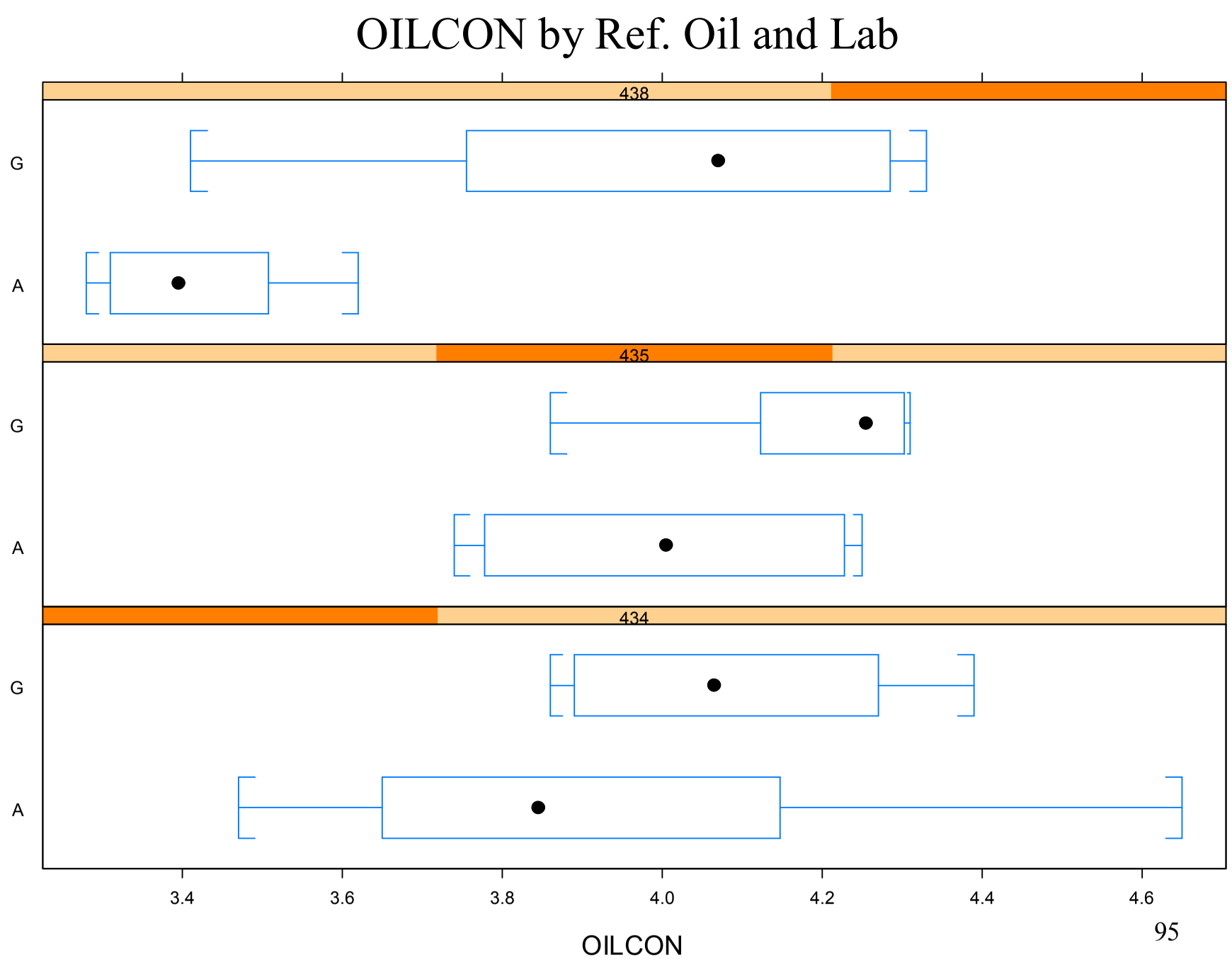

ACLW by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
20
30
40
50
ACLW

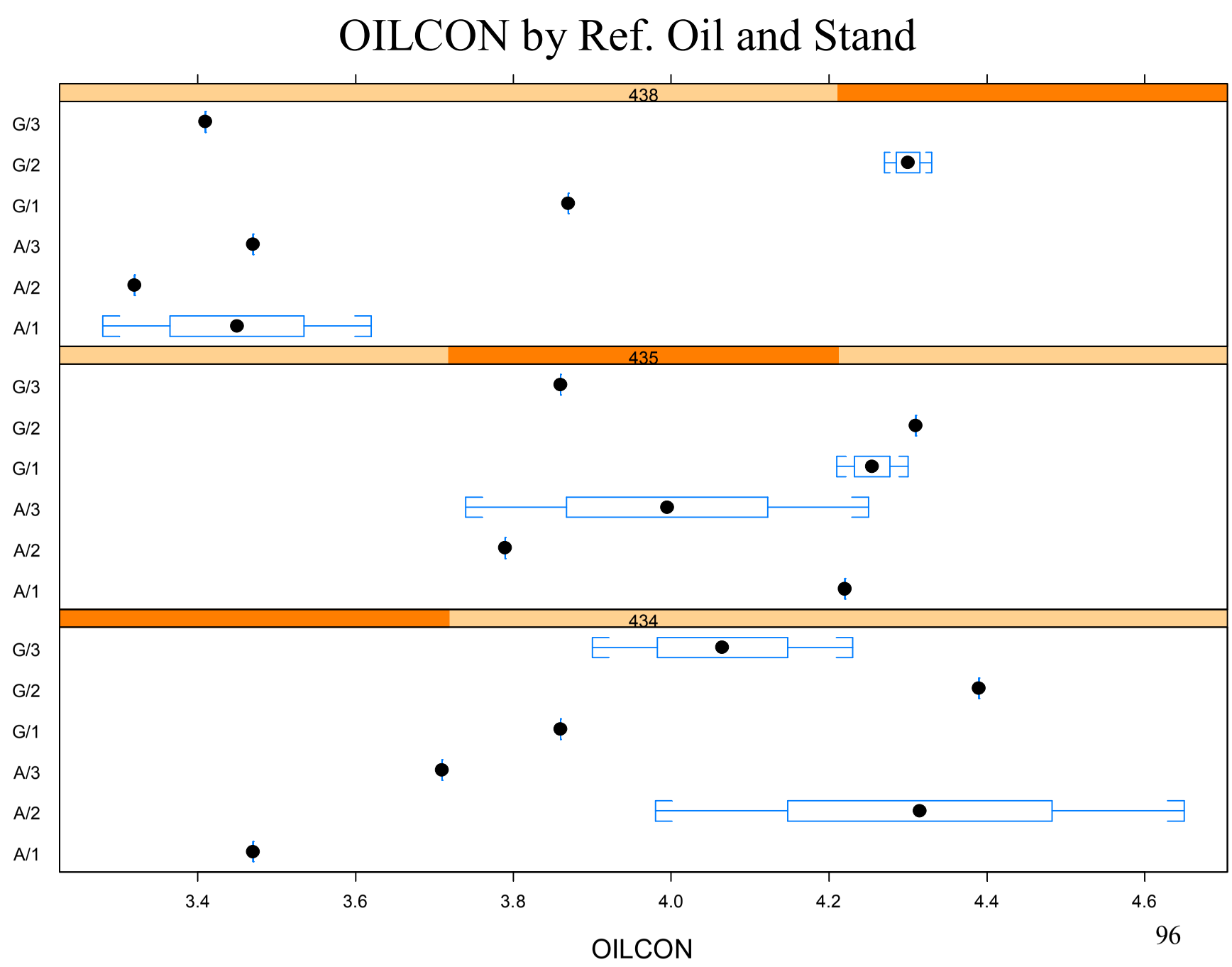

APV by Ref. Oil and Lab
438
435
434
G
A
G
A
G
A
8.0
8.2
8.4
8.6
8.8
9.0
9.2
9.4
APV


APV by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
8.0
8.2
8.4
8.6
8.8
9.0
9.2
9.4
APV

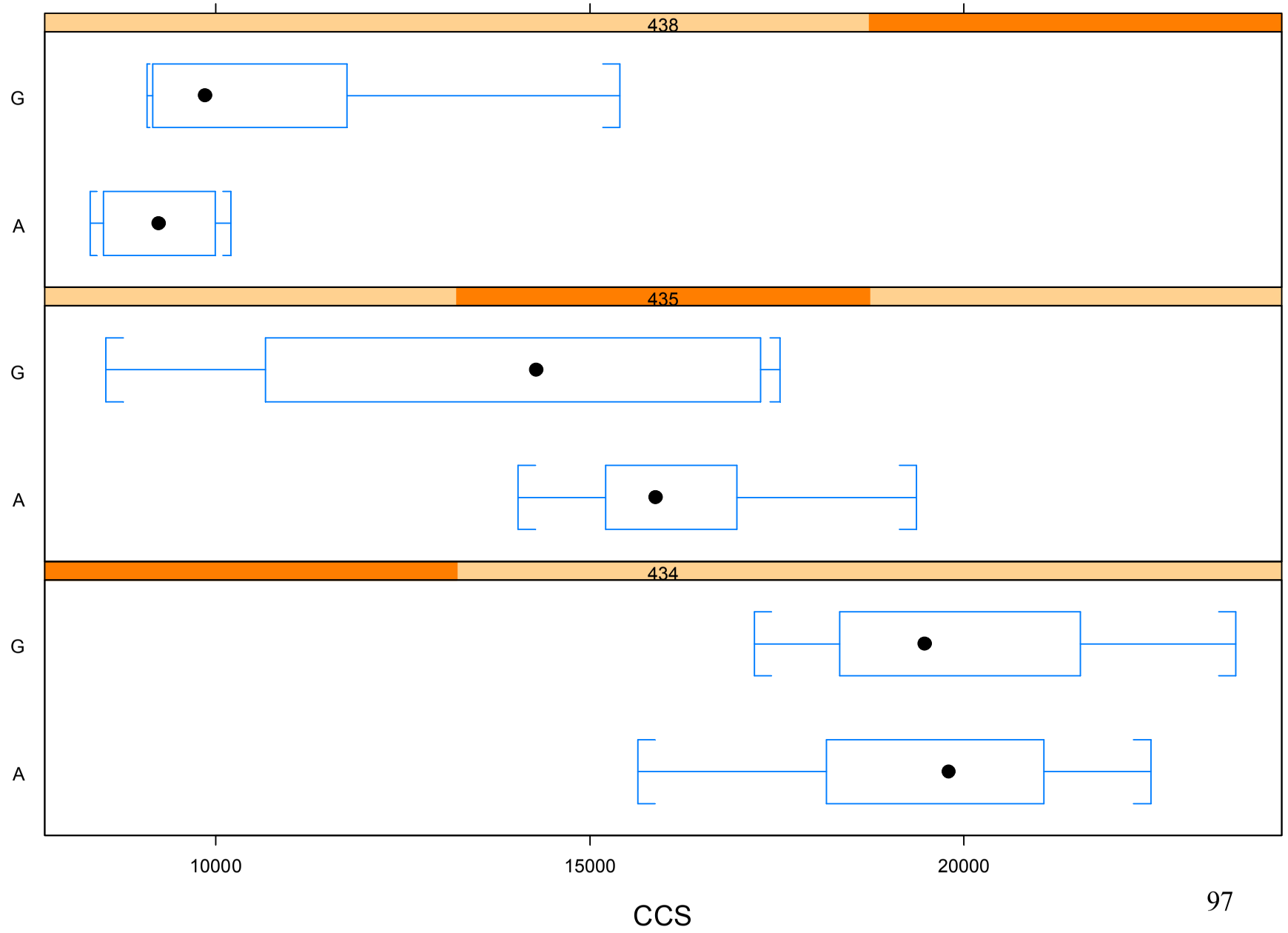

WPD by Ref. Oil and Lab
438
435
434
G
A
G
A
G
A
3.0
3.5
4.0
4.5
5.0
5.5
WPD


WPD by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
3.0
3.5
4.0
4.5
5.0
5.5
WPD

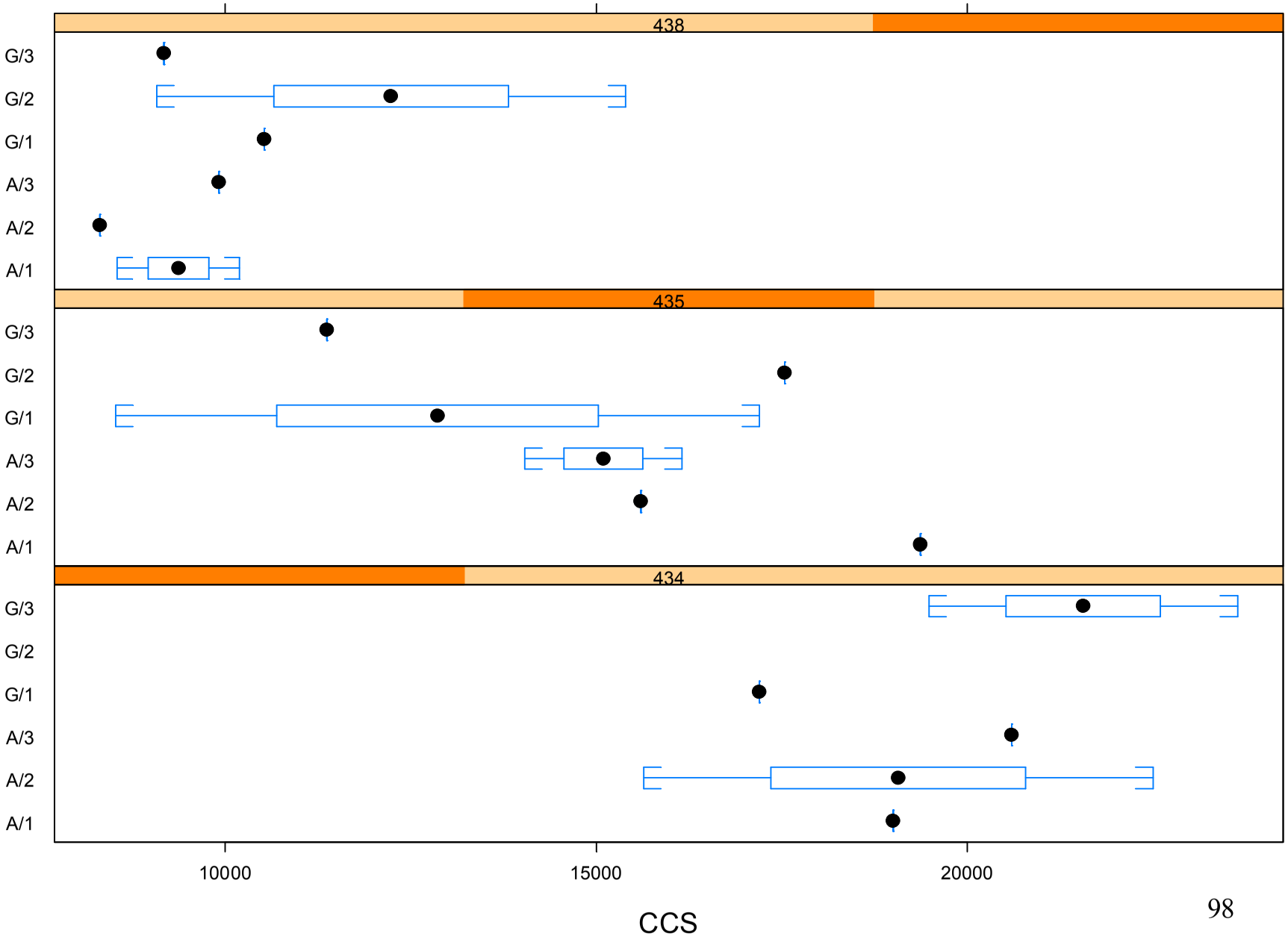

OILCON by Ref. Oil and Lab
438
435
434
G
A
3.4
3.6
3.8
4.0
4.2
4.4
4.6
OILCON

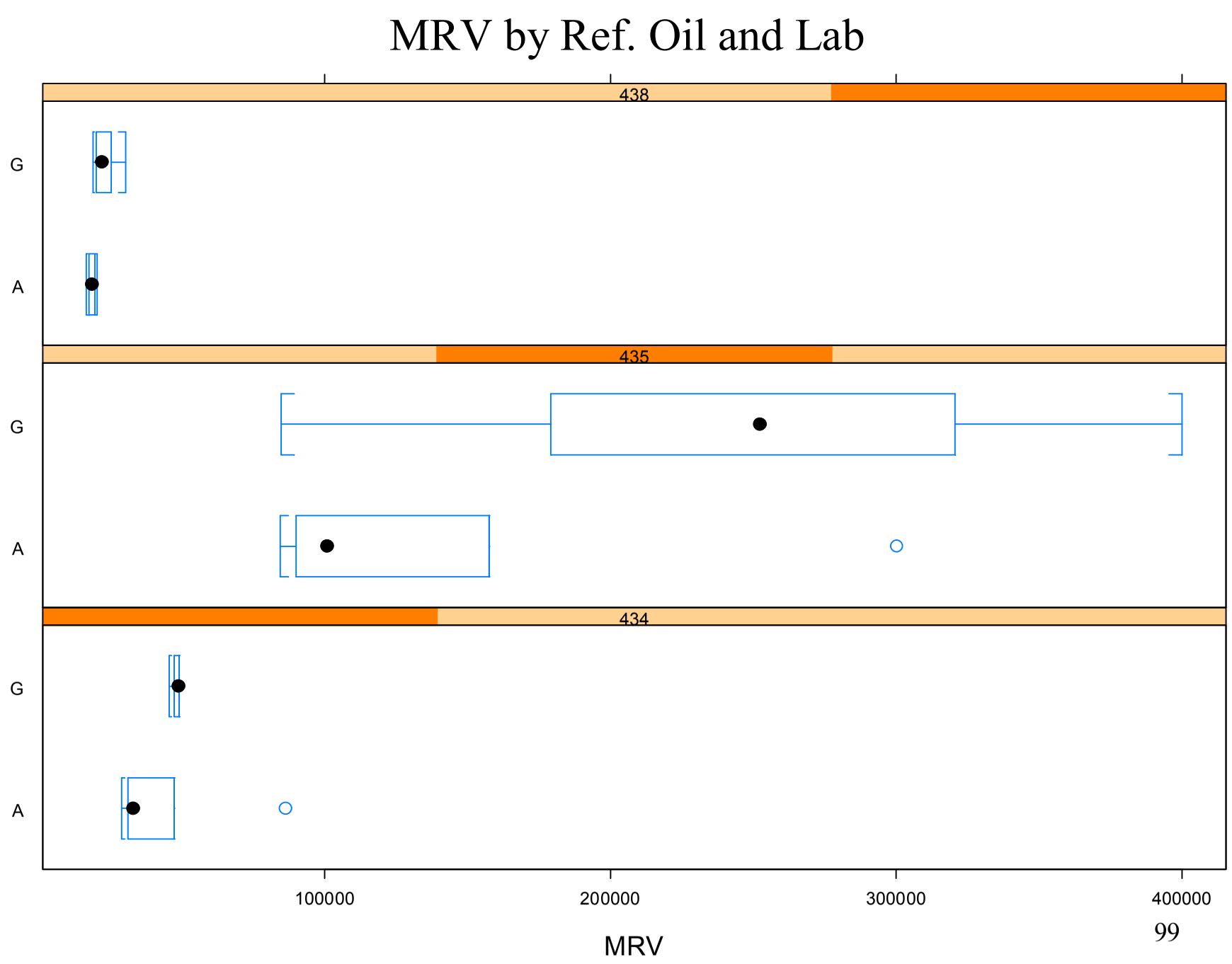

OILCON by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
3.4
3.6
3.8
4.0
4.2
4.4
4.6
OILCON

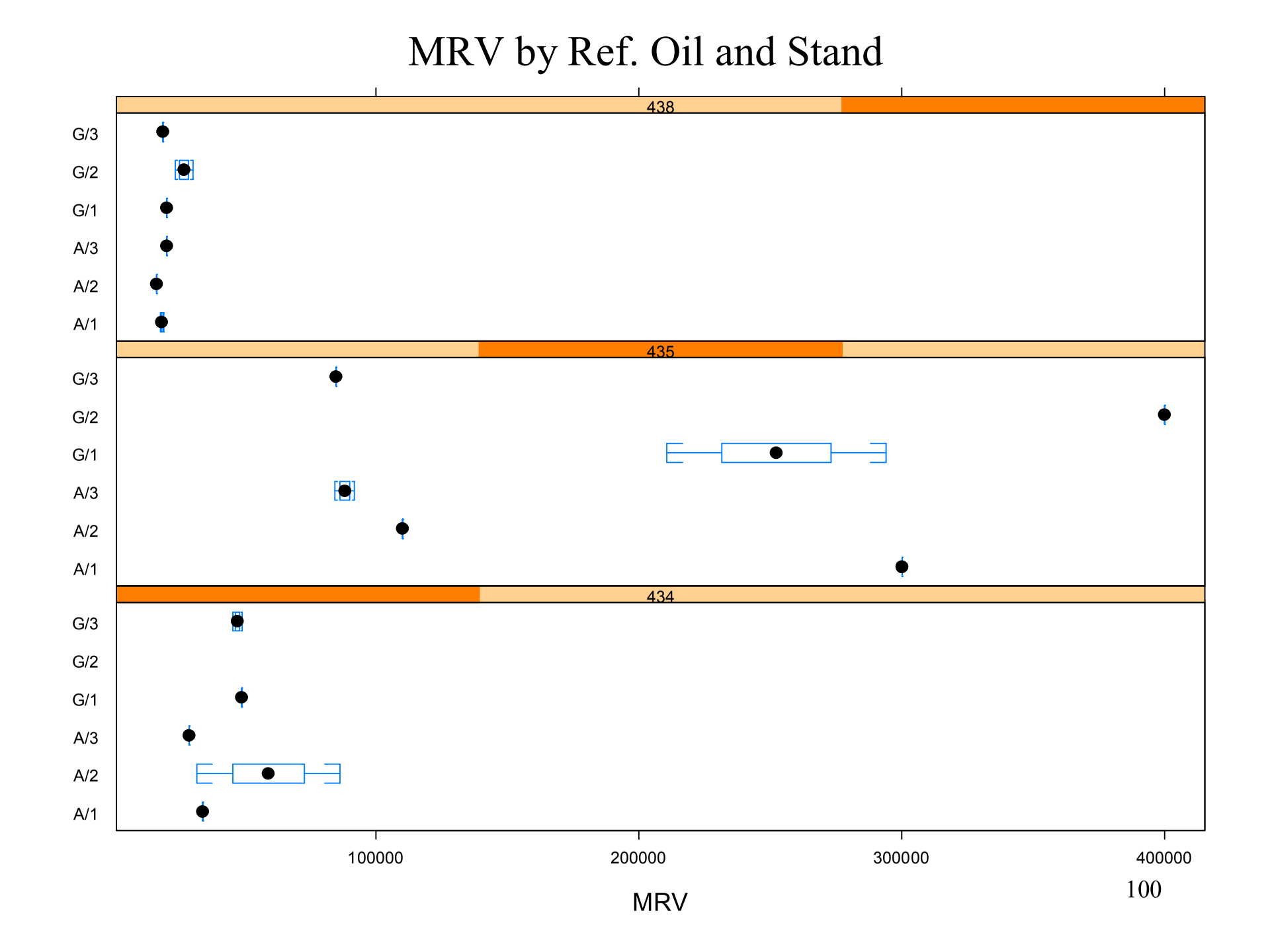
CCS by Ref. Oil and Lab



CCS by Ref. Oil and Stand




MRV by Ref. Oil and Lab
438
435
434
G
A
G
A
G
A
100000
200000
300000
400000
MRV


MRV by Ref. Oil and Stand
438
435
434
G/3
G/2
G/1
A/3
A/2
A/1
100000
200000
300000
400000
MRV

Summary of unusual observations by parameter

PVIS:

	TESTKEY	IND	PVIS	FitPVIS
1	47905	435	163.4	234.8035
13	47886	434	249.5	105.1950
20	47885	434	62.8	105.1950

ACLW:

	TESTKEY	IND	ACLW	FitACLW
5	47884	434	26.2	37.05821
9	47906	435	26.8	35.84254
16	47908	435	48.7	35.84254

APV:

	TESTKEY	IND	APV	FitAPV
5	47884	434	9.43	8.88750
6	47910	438	9.39	8.81625
22	47914	438	8.26	8.81625

OILCON:

	TESTKEY	IND	OILCON	FitOILCON
6	47910	438	4.27	3.839583
11	47911	438	4.33	3.839583
13	47886	434	4.65	3.880417

WPD:

	TESTKEY	IND	WPD	FitWPD
4	47901	434	3.15	4.145
5	47884	434	5.83	4.530
15	47913	438	4.17	3.085

MRV:

	TESTKEY	IND	MRV	FitMRV
1	47905	435	84800	195105.53
10	47889	435	300200	119732.58
13	47886	434	86400	38078.72

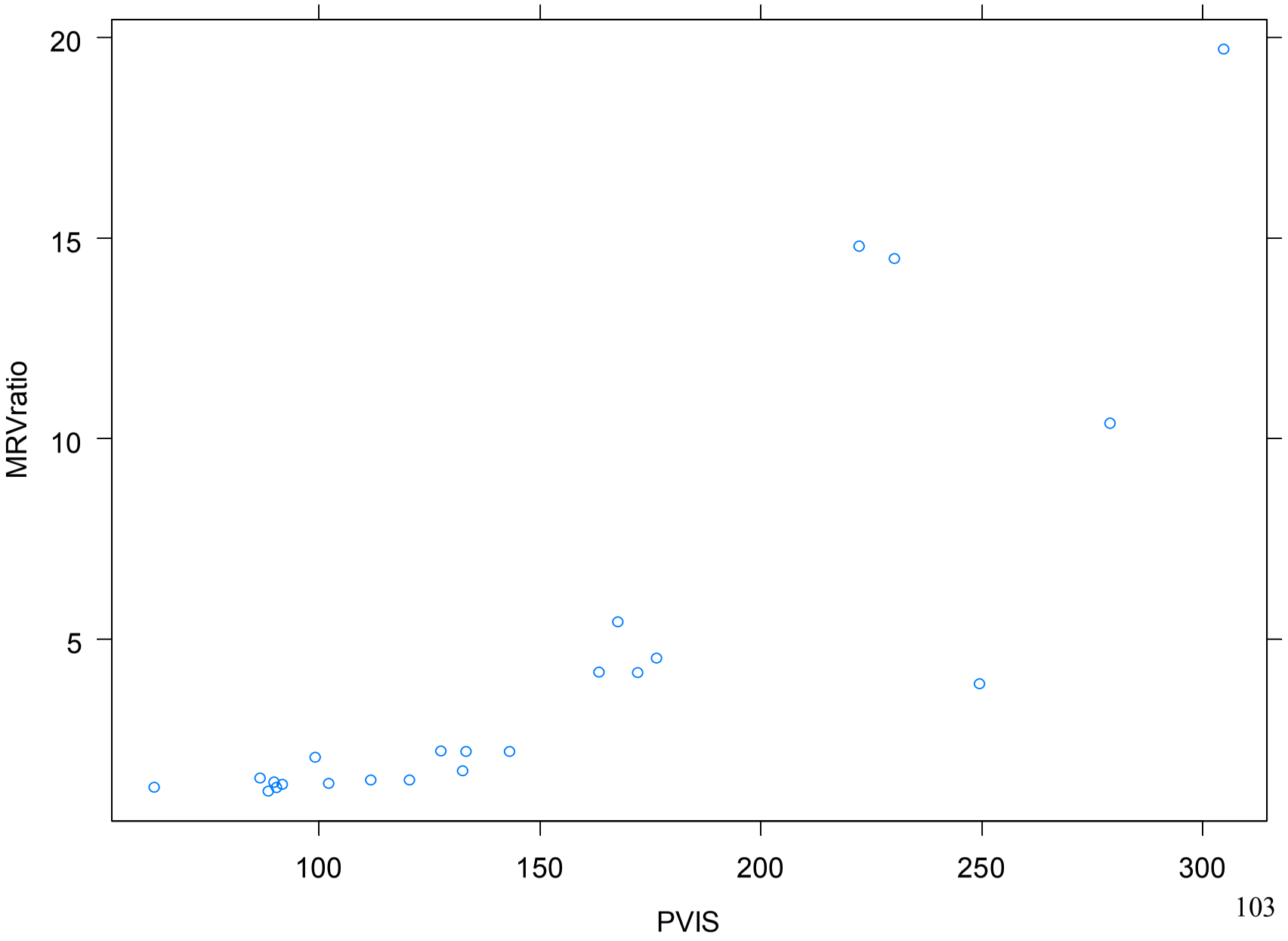
CCS:

	TESTKEY	IND	CCS	FitCCS
7	47900	434	23640	19671.50
9	47906	435	8530	14931.31
11	47911	438	15400	10102.56

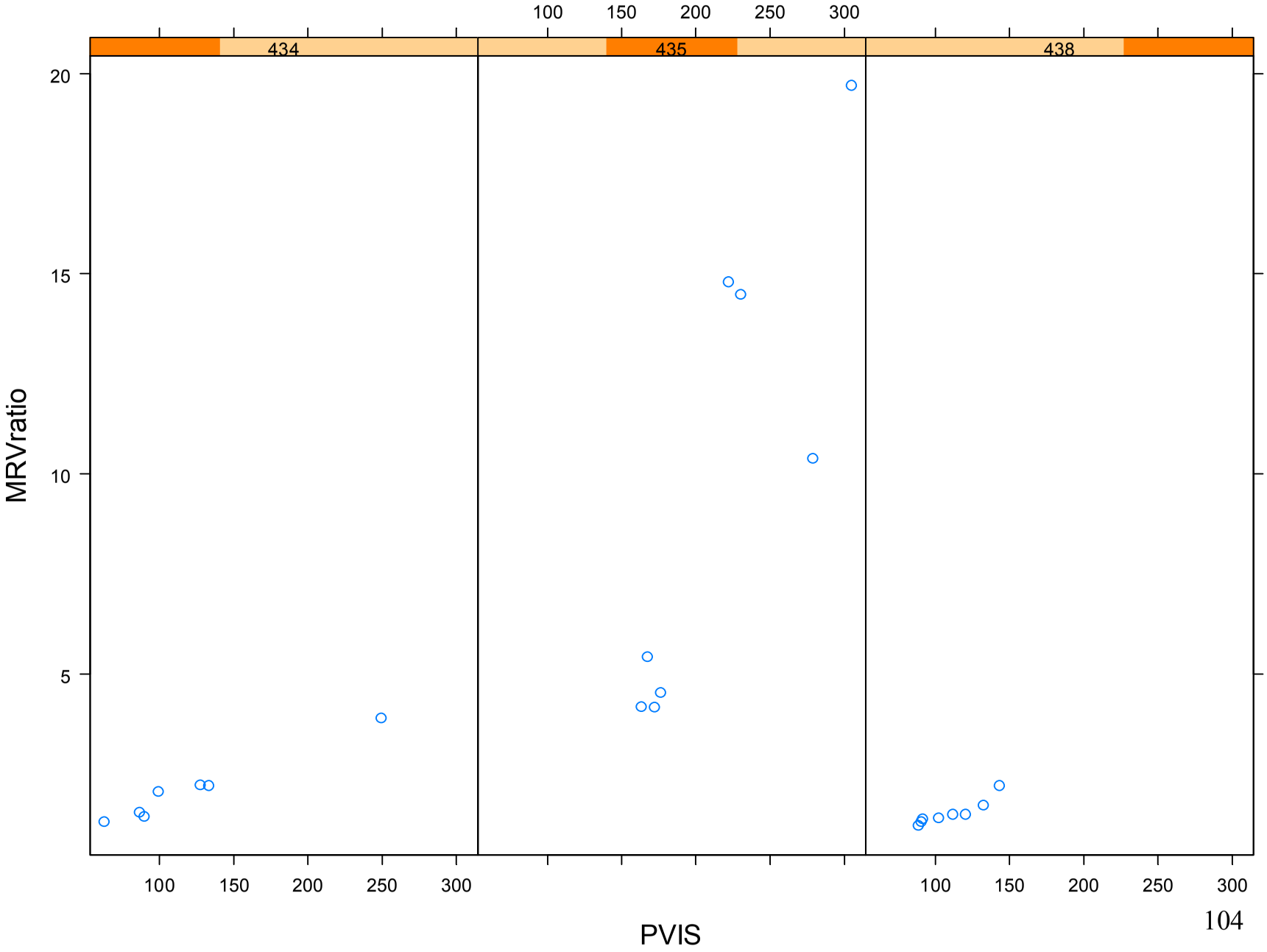
Unusual for 1 parameter : 4, 7, 10, 15,16, 20, 22
Unusual for 2 parameters: 1, 6, 9, 11
Unusual for 3 parameters: 5, 13

Correlation of MRV and PVIS

Used Oil MRV over Fresh Oil MRV versus PVIS



Used Oil MRV over Fresh Oil MRV versus PVIS by Oil



APV Round Robin Data

Lab	Rater	P1T	P1AT	P2T	P2AT	P3T	P2AT	P4T	P4AT	P5T	P5AT	P6T	P6AT	APV
A	JMR	7.81	9.17	6.75	9.50	7.95	9.39	6.12	9.35	8.16	9.42	5.84	9.48	8.24
A	GC	8.14	9.03	6.46	9.25	7.84	9.18	5.69	9.25	7.48	9.33	6.68	9.62	8.16
G	OG	8.07	9.19	6.34	9.61	7.82	9.38	5.57	9.40	7.75	9.80	6.48	9.81	8.27
M	JK	8.17	9.00	6.10	9.42	7.62	9.19	4.90	9.08	6.72	9.46	5.90	9.61	7.93
M	PRA	7.68	9.12	5.55	9.32	6.89	8.96	4.62	9.08	6.48	9.28	5.18	9.39	7.63
E	DC	7.36	9.03	6.62	9.51	7.22	9.39	5.76	9.50	7.07	9.64	6.75	9.82	8.14
F	BJH	7.11	8.74	5.10	9.25	6.86	9.25	4.44	9.03	6.13	9.30	5.63	9.57	7.53
F	SWA	7.36	8.82	5.44	9.35	7.12	9.10	5.02	9.20	6.86	9.47	5.80	9.63	7.76
B	TRG	7.96	9.20	6.48	9.38	7.63	9.24	5.72	9.42	7.64	9.28	6.96	9.43	8.20
B	PJY	8.01	9.08	6.42	9.42	7.64	9.22	5.66	9.20	7.11	9.33	6.45	9.47	8.08
	Average	7.77	9.04	6.13	9.40	7.46	9.23	5.35	9.25	7.14	9.43	6.17	9.58	7.99
	Std Dev.	0.37	0.15	0.56	0.12	0.40	0.14	0.56	0.16	0.62	0.17	0.58	0.15	0.27
	Median	7.89	9.06	6.38	9.40	7.63	9.23	5.62	9.23	7.09	9.38	6.18	9.59	8.11
	Maximum	8.17	9.20	6.75	9.61	7.95	9.39	6.12	9.50	8.16	9.80	6.96	9.82	8.27
	Minumum	7.11	8.74	5.10	9.25	6.86	8.96	4.44	9.03	6.13	9.28	5.18	9.39	7.53
	Target Avg.	8.01	9.13	6.52	9.45	7.87	9.32	5.79	9.33	7.80	9.52	6.33	9.64	8.22
	Target Std. Dev.	0.17	0.09	0.21	0.18	0.07	0.12	0.29	0.08	0.34	0.25	0.44	0.17	0.06
	Yi Values, based upon targets from the GF-4 Matrix Laboratories													
A	JMR	-1.13	0.46	1.11	0.25	1.14	0.62	1.13	0.22	1.06	-0.39	-1.12	-0.95	0.29
A	GC	0.77	-1.15	-0.27	-1.10	-0.43	-1.15	-0.36	-1.09	-0.92	-0.75	0.79	-0.10	-1.11
G	OG	0.36	0.69	-0.84	0.85	-0.71	0.53	-0.77	0.87	-0.14	1.14	0.33	1.05	0.82
M	JK	0.94	-1.49	-1.98	-0.18	-3.57	-1.07	-3.09	-3.32	-3.14	-0.23	-0.99	-0.16	-5.16
M	PRA	-1.88	-0.11	-4.59	-0.72	-14.00	-3.01	-4.06	-3.32	-3.85	-0.95	-2.63	-1.49	-10.43
E	DC	-3.72	-1.15	0.49	0.31	-9.29	0.62	-0.12	2.18	-2.12	0.49	0.95	1.11	-1.47
F	BJH	-5.16	-4.47	-6.72	-1.10	-14.43	-0.56	-4.68	-3.97	-4.87	-0.87	-1.60	-0.40	-12.19
F	SWA	-3.72	-3.56	-5.11	-0.56	-10.71	-1.83	-2.67	-1.75	-2.74	-0.19	-1.22	-0.04	-8.15
B	TRG	-0.27	0.80	-0.17	-0.40	-3.43	-0.65	-0.25	1.13	-0.46	-0.95	1.43	-1.25	-0.41
B	PJY	0.02	-0.57	-0.46	-0.18	-3.29	-0.82	-0.46	-1.75	-2.01	-0.75	0.27	-1.01	-2.52

ATTACHMENT 5

Revision of the Lubricant Test Monitoring System (LTMS) for the Sequence IIIG by ACC & Independent Test Labs

presented by
Ben Weber

June 10, 2003

ATTACHMENT 6

IIIG Enhancements

- Treat lab based tests appropriately
- Restructure the calibration frequency
- Adjust K values and alarm consequences
- Update the methodology for monitoring precision

- Why?
  - Improve calibration test efficiency by
    - More cost effective testing
    - Even distribution of calibration testing
  - Eliminate calibration test "Do Loops"

A6-1

LTMS Reality

- A lab must run at least 4 to 6 calibration tests a year to have a decent chance of detecting a 1 standard deviation shift
- A deterioration in lab precision increases the number of calibration tests needed to detect a 1 standard deviation shift
- Calibration tests cost money
- LTMS needs to be adjusted to deal with the realities of cost and problem detection power

Why a Lab Based Calibration System?

The Reference Oil Database was analyzed in June 2001 following a request by the LTMS Task Force Chair for several engine tests to determine the extent of Lab and Stand effects. Only Control Chartable Data is analyzed. Except for the Caterpillar 1K, Caterpillar 1N and Mack T8 where the most recent 4 to 6 years were analyzed, all of the data generated to date is modeled using Oil, Lab, Stand within Lab, and Run Order as factors. A summary of the analysis is provided below. In most cases, effects due to differences in Labs are greater than effects due to differences in Stands within a Lab.

Engine Test	Parameter	Lab Effect	Stand Effect	Engine Effect	Lab Effect > Stand Effect
IIIF	Vis Inc @ 80 Hours	No	No		Yes
	Weighted Piston Deposits	Yes	No		Yes
	Average Piston Varnish	No	No		Yes
	Avg Cam plus Lifter Wear	No	No		Yes
	Oil Consumption	Yes	No		Yes
VG	Average Engine Sludge	No	No		No
	Oil Screen Clogging	No	No		Yes
	Rocker Cover Sludge	No	No		No
	Average Engine Varnish	No	No		Yes
	Average Piston Varnish	No	No		Yes
IVA	Average Cam Wear	Yes	No		Yes
VIII	Total Bearing Weight Loss	No	No	No	Yes
	10 Hour Stripped Viscosity	Yes	No	Yes	Yes
1K	Weighted Demerits	No	No		No
	Top Groove Fill	Yes	Possible		Yes
	Top Land Heavy Carbon	Possible	No		Yes
	Oil Consumption	No	Possible		No
	EOT Oil Consumption	No	No		Yes
1N	Weighted Demerits	Yes	No		Yes
	Top Groove Fill	No	No		Yes
	Top Land Heavy Carbon	Yes	No		Yes
	Oil Consumption	No	No		Yes
T8E	Vis Inc @ 3.8% Soot	No	No		No
	EOT Viscosity	Possible	No		Yes

Does the Sequence III LTMS Need Changing?

- Well how is the IIIF been doing?
- In reviewing the LTMS data listed on the TMC website we find

31% of 250 tests

NOT CHARTABLE!

A6-4

New LTMS Methodology

- Stands are selected for calibration tests on a rotational basis
- A minimum of two (2) Operationally Valid & Statistically Acceptable (OVSA) calibration tests are required in the lab before calibration of the lab for registered candidate testing
- At least one (1) OVSA calibration test must be conducted on a stand before a registered candidate test may be run in that stand
- A calibration test must be started by the 100th day from the last calibration test completed in the lab
- No more than 25 candidates can be completed in the lab before the next calibration test start in the lab
  - Labs stay calibrated during reference period even if the current calibration attempt fails
    - Re-attempts must be in the same stand.
  - A stand calibration is limited to a maximum of 365 days

New LTMS Methodology - Page 2

- The lab must notify TMC and RSI when they decide to remove a stand from the calibration pool/LTMS
- Removal of a stand that has been used to test registered candidates does not warrant removal of data from the lab control charts
  - Bringing stands back into LTMS requires one OVSA calibration test once the lab is calibrated
- Set the K values for Shewhart severity at 2.0 vs 1.8
  - In case of alarm, run an additional calibration test in the same stand
  - If the alarm is in the same direction as a previously existing severity adjustment, increase the K value for shewhart severity to 3.0 and recheck alarm
- Set the K values for EWMA severity at 1.65 vs 1.96
- For new oil introductions and re-blends
  - The precision alarm consequences and severity adjustments will be suspended until Industry Targets are set from at least 8 OVSA calibration tests

D 5-6

Precision Monitoring & Consequences

- Monitor precision after every test using the standard deviation of Yi in blocks of four tests (S).

- IF S > 1.6135
  - Run one additional OVSA calibration test on the next stand in the rotation
  - IF S > 2.4203
    - Run one additional OVSA calibration test on the next stand in the rotation, PLUS, reduce the calibration interval from 100 to 80 days or 20 candidates until 4 calibration tests are collected
  - IF S > 3.2270
    - Run one additional OVSA calibration test on the next stand in the rotation, PLUS, reduce the calibration interval to 55 days or 14 candidates until 4 calibration tests are collected

Example Data Table - Needs Update

Yi	S (in blocks of 4)	Zi
1.3		0.3900
-2.2		-0.3870
-1.3		-0.6609
1.8	1.9511	0.0774
-0.4	1.7154	-0.6584
2.4	1.7595	0.6739
-0.7	1.5543	0.2617
-0.9	1.5470	-0.0868
1.4	1.6135	0.3593
1.0	1.1690	0.5515
-1.8	1.5262	-0.1540
1.7	1.6091	0.4022
0.7	1.5253	0.4916
-3.1	2.2111	-0.5859
2.4	2.4514	0.3099
0.3	2.3042	0.3069
-1.2	2.3281	-0.1452
1.7	1.5937	0.4084

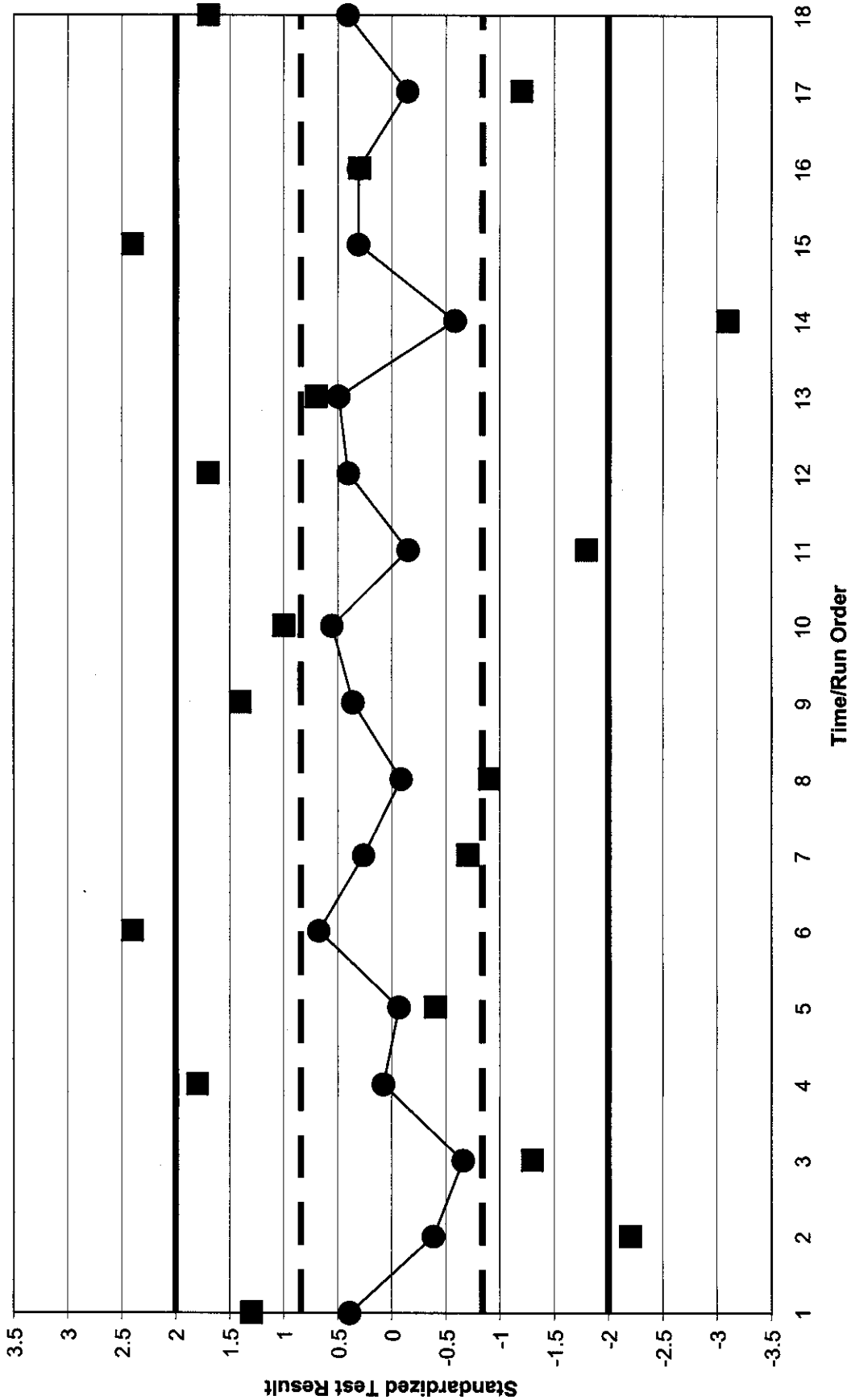
Note: S = StDev of 4 Yi values

Current LTMS Equations:

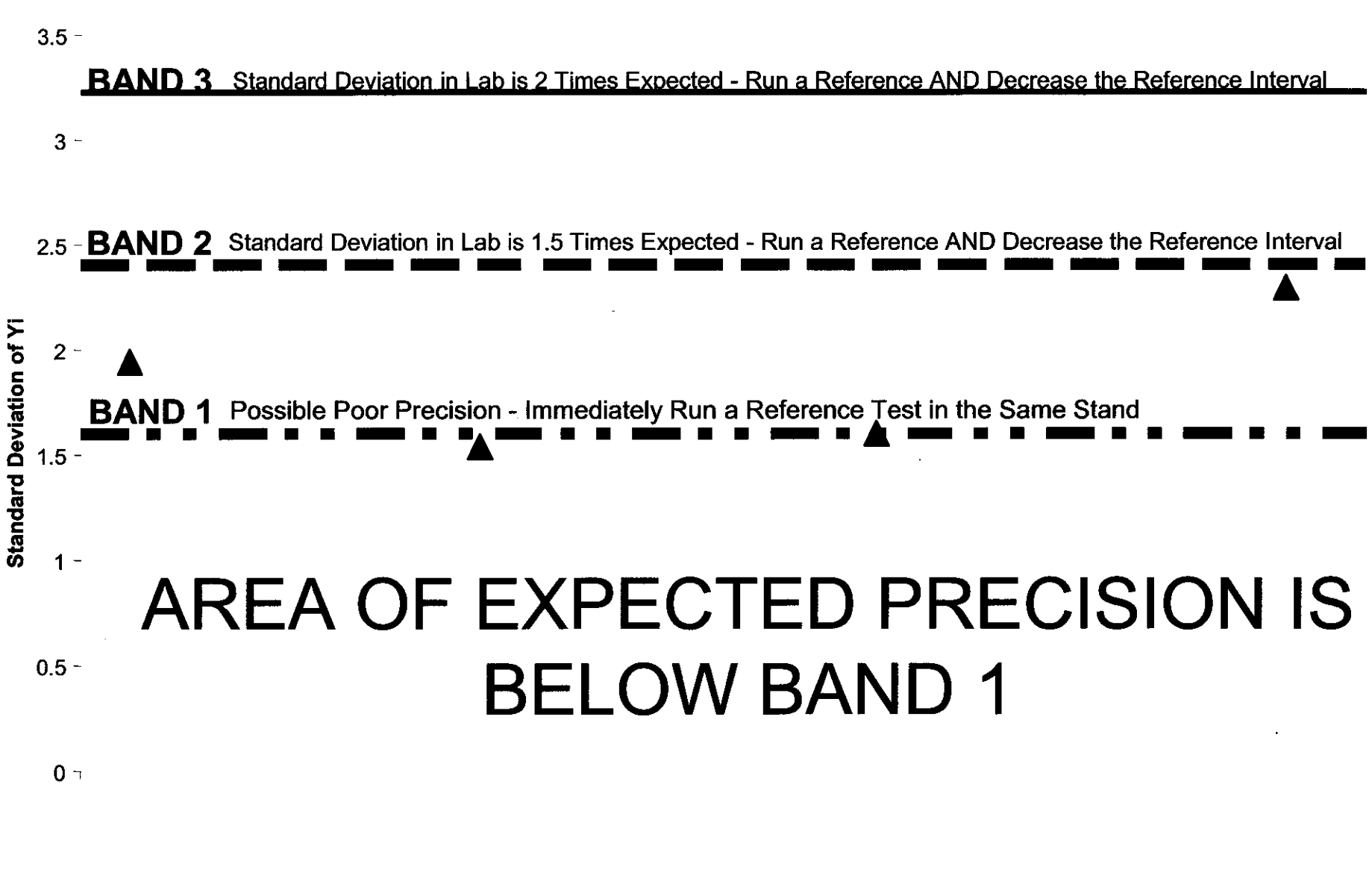
$$Y_i = \frac{T_i - MEAN}{\sigma}$$

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

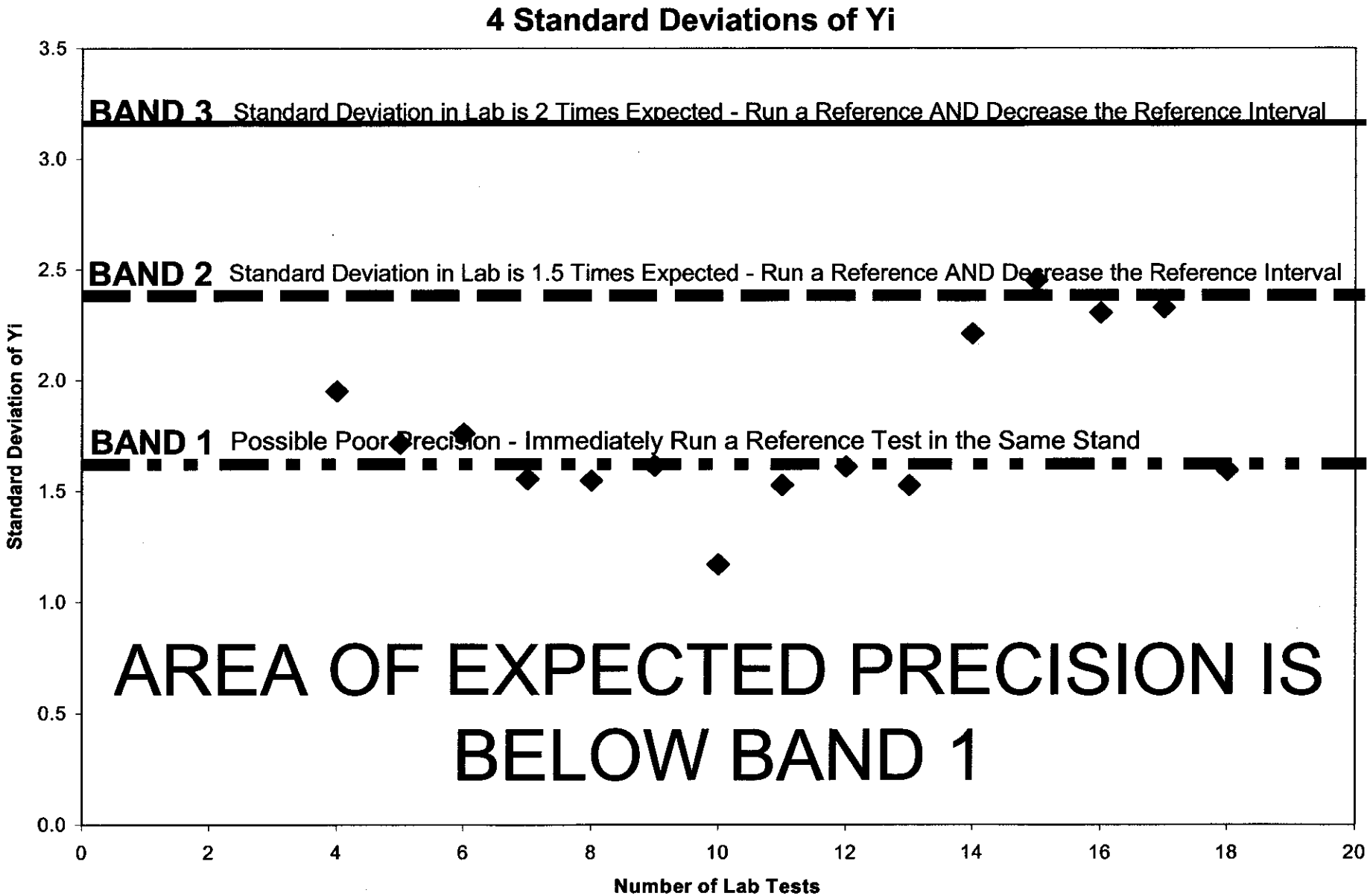
LTMS Severity Chart



LTMS Precision Chart - Proposed



LTMS Precision Chart - Accepted at Meeting



A6-11

Tale of the Tape for the IIIG

Current System	Proposed System
15 non-ref tests max per stand	25 non-ref tests max per lab
Ref test in stand every 120 days	Ref test in lab every 100 days
Stand calibrated with 2 ref tests, no requirement for the lab	Stand calibrated with 1 ref test, lab calibrated with 2 ref tests
Stand Alarms	No Stand Alarms
Severity Shewhart K=1.80	Severity Shewhart K=2.0 (K=3.0 if SA)
Severity EWMA K=1.96	Severity EWMA K=1.65
Precision Monitored Every Test	Precision Monitored Every Test in Block of 4
Precision Monitored with EWMA	EWMA NOT used for precision

IIIG LTMS Proposal Advantages

- System Now in-line with Lab Based SA System
  - Calibration tests are conducted on a lab basis not a stand basis
- Calibration Cost and Time Savings
  - Approach would have eliminated some of the IIIF calibration testing
- Consistent Timely Reference Testing in a Lab
  - Calibration tests will not be bunched
  - Calibration testing will better match Industry demand
- Updated Technical Practice for Precision will Eliminate Calibration Test "Do Loops"
  - Laboratory precision check strengthened by using data in groups of four versus last EWMA result

Observations & Thoughts on a Revised IIIG LTMS

TMC - June 10, 2003

ATTACHMENT 7

TMC Desires

- To have technical items regarding the LTMS discussed and understood openly
- NOT to be a roadblock on any decision that the Surveillance Panel approves
- To implement a Surveillance Panel approved system in a timely manner

TMC Observation

- The new proposal is eliminating the stand based calibration system
- The panel should consider:
  - TMC has observed problem stands
  - Many lab based precision issues are stand based
  - Analysis of variance of control chartable data base does not always show a strong stand influence

TMC Observation

- Lab precision monitoring method is being revised
  - Every 4th test monitoring coupled with 100 day testing requirement allows for lab problems to exist for as long as 400 days
  - The panel may wish to consider a system that monitors precision every test with relaxed precision responses

Reasonable Changes to Current System

- Change severity Shewhart K to 2.0 from 1.80
- Change EWMA severity K to 1.65 from 1.96
- No stand precision responses other than noting in test report
- No stand EWMA severity monitoring
- One (1) OVSA calibration test must be conducted on a new stand
- No Laboratory Shewhart Precision Monitoring

Other Suggestions

- If a lab does not have greater than 5 data points no severity adjustment is implemented
- No requirement for 2 tests at lab
- Maintain stand calibration period
- Calibrate each stand every 120 days or 18 starts

Other Suggestions

- EWMA Laboratory Precision Alarms
  - Drop Warning Alarm
  - Action: Run another test
  - Note precision alarm in test report

	Current System	New Proposal	Another Option
Stand Calibration	Every 120 days or 15 starts	Every 365 days	Every 120 days or 18 starts
New Stand	2 tests with no stand alarms	1 op. valid, stat acceptable	1 op. valid, stat acceptable
Lab Calibration	None – Stand Based	100 days or 25 NR tests	None – Stand Calibration
New Lab Calibration	2 tests on stand	2 op. valid, stat. acceptable	1 test on stand
SA Implementation	2 op valid, stat. acceptable	2 op valid, stat. acceptable	5 op. valid @lab
Severity Shewhart K	1.80	2.00 (3.00 with S.A.)	2.00
Lab Severity EWMA	1.96	1.65	1.65
Stand Alarms	EWMA & Shewhart	None	Monitor Only
Lab Precision Alarms	EWMA & Shewhart	4 test average	EWMA
Precision Monitoring Frequency	Every test	Every 4th test	Every test
Precision False Alarm Error Rate	Warning 5%, Action=1%	New Methodology	Action 1%
Precision Alarm Response	Warning: Run 2 tests in lab Action:Cease starts	Run one OVSA test in stand and possibly reduced calibration period	Action: Run one test in lab

Time Limit Example A: One Stand Lab

Current System		
	Stand 1	# of references
First Test	X	1
Second Test	X	1
120 days	X	1
240	X	1
360	X	1
Total		5

New Proposal		
	Stand 1	# of references
First Test	X	1
Second Test	X	1
100 days	X	1
200	X	1
300	X	1
Total		5

150 day review		
	Stand 1	# of references
First Test	X	1
150 days	X	1
300	X	1
Total		3

Time Limit Example B: Two Stand Lab

Current System			
	Stand 1	Stand 2	# of references
First Test	X	X	2
Second Test	X	X	2
120 days	X	X	2
240	X	X	2
360	X	X	2
Total			10

New Proposed System			
	Stand 1	Stand 2	# of references
First Test	X	X	2
100 days	X		1
200		X	1
300	X		1
Total			5

150 day review			
	Stand 1	Stand 2	# of references
First Test	X	X	2
150 days	X	X	2
300	X	X	2
Total			6

Time Limit Example C: Three Stand Lab

Current System				
	Stand 1	Stand 2	Stand 3	# of references
First Test	X	X	X	3
Second Test	X	X	X	3
120 days	X	X	X	3
240	X	X	X	3
360	X	X	X	3
Total				15

New Proposed System				
	Stand 1	Stand 2	Stand 3	# of references
First Test	X	X	X	3
100 days	X			1
200		X		1
300			X	1
Total				6

150 day review				
	Stand 1	Stand 2	Stand 3	# of references
First Test	X	X	X	3
150 days	X	X	X	3
300	X	X	X	3
Total				9

Time Limit Example D: 4 Stand Lab

Current System					
	Stand				# of references
	1	2	3	4	
First Test	X	X	X	X	4
Second Test	X	X	X	X	4
120 days	X	X	X	X	4
240	X	X	X	X	4
360	X	X	X	X	4
Total					20

New Proposal System					
	Stand				# of references
	1	2	3	4	
First Test	X	X	X	X	4
100 days	X				1
200		X			1
300			X		1
365				X	1
Total					8

150 day review					
	Stand				# of references
	1	2	3	4	
First Test	X	X	X	X	4
150 days	X	X	X	X	4
300	X	X	X	X	4
365	1/3	1/3	1/3	1/3	1-1/3
Total					~13

Run Number Example A: One Stand Lab

Current System (90 days/ 15 starts)		
	Stand 1	# of references
First Test	X	1
Second Test	X	1
90 days	X	1
180	X	1
270	X	1
360	X	1
Total		6

New Proposal (150 days/ 25 starts)		
	Stand 1	# of references
First Test	X	1
Second Test	X	1
100 * days	X	1
200	X	1
300	X	1
Total		5

* Every 100 days supersedes 150 days

Another Option (108 days /18 starts)		
	Stand 1	# of references
First Test	X	1
108 days	X	1
216	X	1
324	X	1
Total		4

Run Number Example B: Two Stand Lab

Current System (90 days / 15 starts)			
	Stand 1	Stand 2	# of references
First Test	X	X	2
Second Test	X	X	2
90 days	X	X	2
180	X	X	2
270	X	X	2
360	X	X	2
Total			12

New Proposed System (72 days /12 starts/2 stands)			
	Stand 1	Stand 2	# of references
First Test	X	X	2
72 days	X		1
144		X	1
216	X		1
288		X	1
360	X		1
Total			7

Another Option (108 days/ 18 starts)			
	Stand 1	Stand 2	# of references
First Test	X	X	2
108 days	X	X	2
216	X	X	2
324	X	X	2
Total			8

Run Number Example C: Three Stand Lab

Current System (90 days / 15 starts)				
	Stand			# of references
	1	2	3	
First Test	X	X	X	3
Second Test	X	X	X	3
90 days	X	X	X	3
180	X	X	X	3
270	X	X	X	3
360	X	X	X	3
Total				18

New Proposed System (48 days/8 starts/ 3 stands)				
	Stand			# of references
	1	2	3	
First Test	X	X	X	3
48 days	X			1
96		X		1
144			X	1
192	X			1
240		X		1
288			X	1
336	X			1
384		X		1
Total				11

Another Option (108 days / 18 starts)				
	Stand 1	Stand 2	Stand 3	# of references
First Test	X	X	X	3
108 days	X	X	X	3
216	X	X	X	3
324	X	X	X	3
Total				12

Example D: 4 Stand Lab

Current System (90 days / 15 starts)					
	Stand				
	1	2	3	4	# of references
First Test	X	X	X	X	4
Second Test	X	X	X	X	4
90 days	X	X	X	X	4
180	X	X	X	X	4
270	X	X	X	X	4
360	X	X	X	X	4
Total					24

New Proposal System (36 Days/ 6 starts/ 4 stands)					
	Stand 1	Stand 2	Stand 3	Stand 4	# of references
First Test	X	X	X	X	4
36 days	X				1
72		X			1
108			X		1
144				X	1
180	X				1
216		X			1
252			X		1
288				X	1
324	X				1
360		X			1
Total					14

Another Option (108 days/ 18 starts)					
	Stand 1	Stand 2	Stand 3	Stand 4	# of references
First Test	X	X	X	X	4
108 days	X	X	X	X	4
216	X	X	X	X	4
324	X	X	X	X	4
Total					16

ASTM IIIG Surveillance Panel Meeting

June 10, 2003

LOTRUO LIAISON REPORT: IIIG USED OIL MRV INVESTIGATIONS

C.J. May

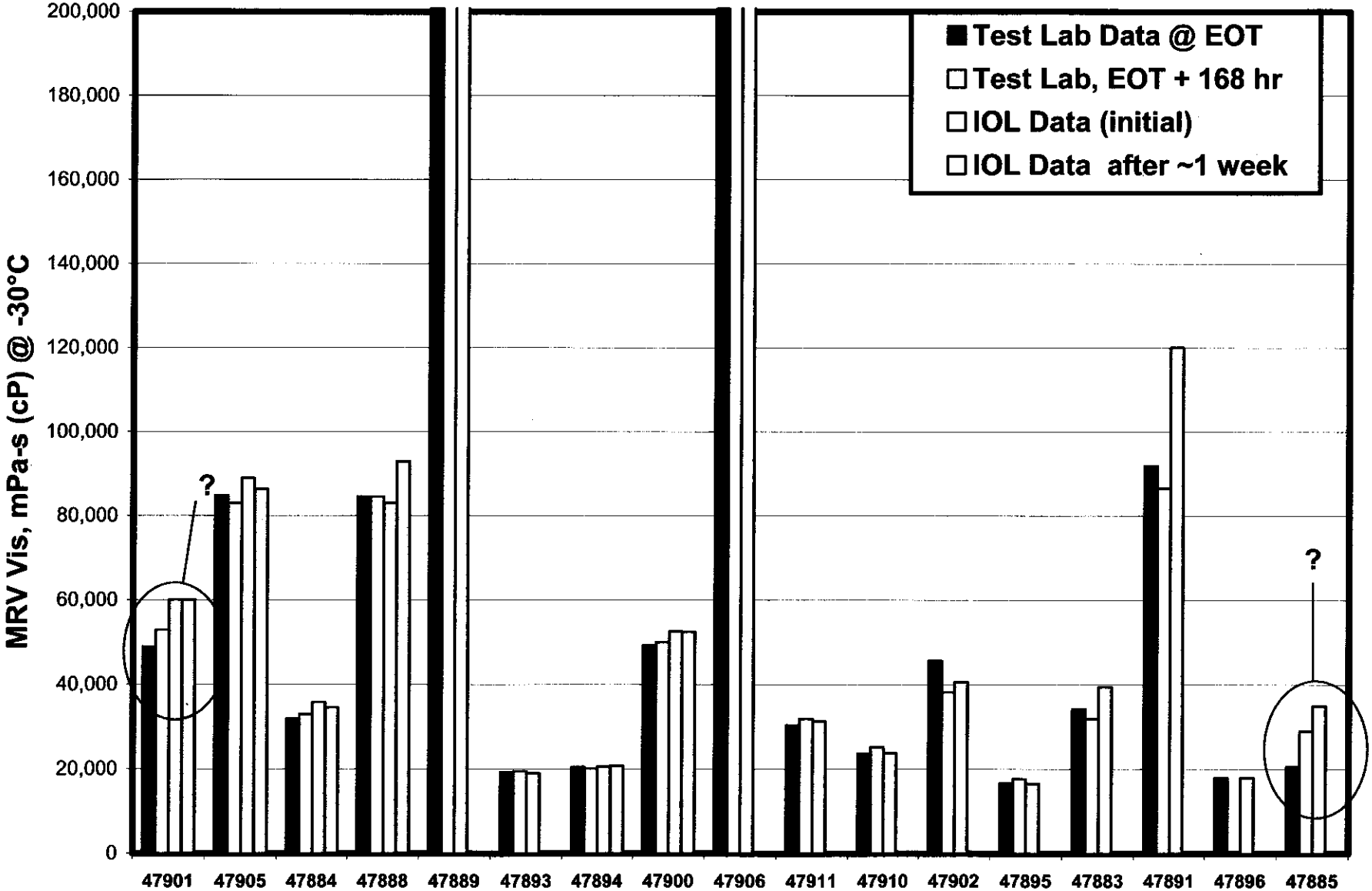
c\astm\lotruo\100603 IIIG.ppt

ATTACHMENT 8

MANY THANKS!

- From mid-May through early June, we have received a total of 21 E-O-T IIIG drain samples from SouthWest Research Institute and Perkin-Elmer Automotive Research
  - sufficient quantities of each oil will allow round robin activity
- Initial studies being done at Imperial Oil to compare results with the test labs, look for any longer term trends in viscosity
  - Initial IOL results obtained ~1-2 weeks after SWRI/PEAR values
  - IOL rerunning many samples after additional storage at room temp
  - Important for us to determine whether viscosities are stable before initiating multi-lab round robin
  - D4684 reproducibility for fresh oils (no yield stress) @-30°C is 18.4% (~9200 for a 50,000 cP oil) ➡ not observing consistent trends in viscosity change with time(see chart; very good agreement in yield stress values between IOL and test labs
  - However, based on these preliminary data, it may be prudent to ensure EOT test results generated within 1 week (e.g. CMIS 47901)

Comparison of MRV Viscosity Results



Future Activities

- Confirm viscosity stability of E-O-T samples
- Select oils to cover range of viscosities/yield stress values for round robin and confirm participants
  - IIIG matrix oils measured at -30°C
  - working on additional samples to allow -25°C round robin at the same time
- Subcommittee 7 task force currently running a fresh oil MRV round robin with modifications to improve test precision
  - plan to wait for outcome of this R/R before starting the used oil interlab program
- Would welcome any other suggestions

Sequence IIIF/G O&H Report

Presented by: Patrick Lang

June 10, 2003

Detroit, Michigan

ATTACHMENT 9

Current Activities

- Piston Skirt Ratings
  - A difference was observed in the method for rating piston skirts in regard to the deposits near the tooling marks.
  - The two San Antonio labs agreed on a method to handle this prior to start of precision matrix.
  - Pistons were sent to all IIIG labs for APV ratings; significant differences were observed.

AA-2

Current Activities (cont'd)

- Due to unavailability of the PF-47 oil filter, an e-motion was made and passed allowing the use of the Protec oil filter in the 3F, part number OHT3G-057-3, effective May 30, 2003. Labs can deplete PF-47's first.
- The use of impregnated front covers (OHT3G-085-1) and oil filter housings (OHT3G-080-1) will be mandatory for IIIG testing.

A9-3

Current Activities (cont'd)

- IIIF dipstick modified (longer) for IIIG.
- Mass air flow sensor part numbers:
  - Original 2-bolt part number 24508238
  - 24508238 superseded with 12568877
  - 1256877 superseded by part number 88961007 (remanufactured)
  - No remanufactured units in the field until later this year

A9-4

Sequence III Solvent Survey

Lab	Brand Name	Type	Class	Flashpoint Deg F	Aromatics (by volume)
A	Exxol D 60	2	C	142	1%
B	Shell Sol 142 Kwik Dri 66	2 1	C ?	142 105	1% 1%
C	Shell Sol 142	2	A	142	8-22%
D	Ashland Mineral Spirits 66	1	C	105	1%
E	Varsol 1	1	A	104	18%
F	Citgo Regular Mineral Spirits	1	A	110	16.2%

A9-5

Parts Cleaning with Jet Washer

- Fresh bath of soap/water prior to matrix
- No new soap added after initial mixing
- NAT-50 used at SwRI and PE
- No rinse cycle

A9-6

ATTACHMENT 10

CENTRAL PARTS DISTRIBUTOR REPORT
OH Technologies, Inc.

Sequence IIIF Surveillance Panel Meeting
Romulus, Michigan
June 10, 2003

1.) Rejections from 11/16/2002 to 06/06/2003:

IIIF Camshaft

Nicks and Scratches / Undercut at Nose, 2 Pieces
Material Replaced

IIIG Camshaft

Bearing Journal Polish Contact w/Lobe, 2 Pieces
Material Replaced

Casting Void in Bearing Journal, 1 Piece
Material Replaced

Main Bearings (Lower)

Defective Plating, Material Evaluated by Vendor, 1 Piece
Material Replaced

2.) Technical Memos Issued

None issued for period

3.) Batch Code Changes

Main Bearing	BC 8	Introduced 3/10/03
Conn. Bearing	BC 10	Introduced 3/10/03
Cam Bearing	BC 8	Introduced 3/10/03
Pistons, GR12	BC 12	Introduced 4/29/03
Pistons, GR34	BC 13	Introduced 5/19/03
Pistons, GR56	BC13	Introduced 5/01/03
Camshaft, IIIF	PC 8 (NJ)	Introduced 3/20/03
Pin, Wrist	BC 5	Introduced 4/01/03
Cooler, Oil	C/SP 030512	Introduced 5/13/03

ATTACHMENT 11

GM Race Shop

Sequence IIIF / IIIG Surveillance Panel Report

Sid Clark
June 10, 2003

Cylinder Heads:

The shallow seat pocket cylinder head recall has been completed. All returned materials have been replaced.

Inventory Status: Ample inventory for testing

Engine Blocks
Cylinder Heads
Crankshafts
Connecting Rods*

Front Covers (Switched to OH Technologies)

*Large quantity received in May. Next order will be Powdered Metal cracked rods

ATTACHMENT 12

THE ASTM SEQUENCE IIIF/G SURVEILLANCE PANEL

SCOPE & OBJECTIVES

SCOPE

The Sequence IIIF/G Surveillance Panel is responsible for the surveillance and continual improvement of the Sequence IIIF test documented in ASTM Standard DNNNN-XX as update by the Information Letter System. Data on test precision and laboratory versus field correlation will be solicited and evaluated at least every six (6) months. The Surveillance Panel is to provide continual improvement of rating techniques, test operation, test monitoring and test validation through communication with the Test Sponsor, ASTM Test Monitoring Center, Operations and Hardware Subpanel, the Central Parts Distributor, ASTM B0.01 Passenger Car Engine Oil Classification Panel, ASTM Light Duty Rating Task Force, ASTM Committee B0.01, CMA Monitoring Agency and CRC Motor Rating Methods Group. Actions to improve the process will be recommended when appropriate based on input to the Surveillance Panel from one or more of the previously stated groups. Develop updated test procedures when necessary and review the correlation with previous test procedures. This process will provide the best possible Sequence III Type Test Procedure for evaluating automotive lubricant performance with respect to the lubricant's ability to prevent oil thickening, varnish formation, oil consumption and engine wear.

OBJECTIVES	TARGET DATE
1. Revise the IIIF Test Method for elevation to ASTM Standard	~~September~~ November 2003
2. Develop the IIIG test for inclusion in the Precision Matrix	Complete April 2003
3. Approve the IIIG test for inclusion in the ILSAC GF-4 Specification	June 2003
4. Resolution of the unexplained, random wear in the IIIF Test Method	Dropped
5. Control System Clarification	September 2003
6. Continue evaluation and analysis of IIIG Precision Matrix Data	
7. Write IIIG Research Report	

William M. Nahumck, Chairman
Sequence IIIF Surveillance Panel

Updated June 10, 2003
Romulus, Michigan