

ROBO

Introduction to ASTM PCEOCP & Status Update

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October 23, 2008

ROBO

Goal

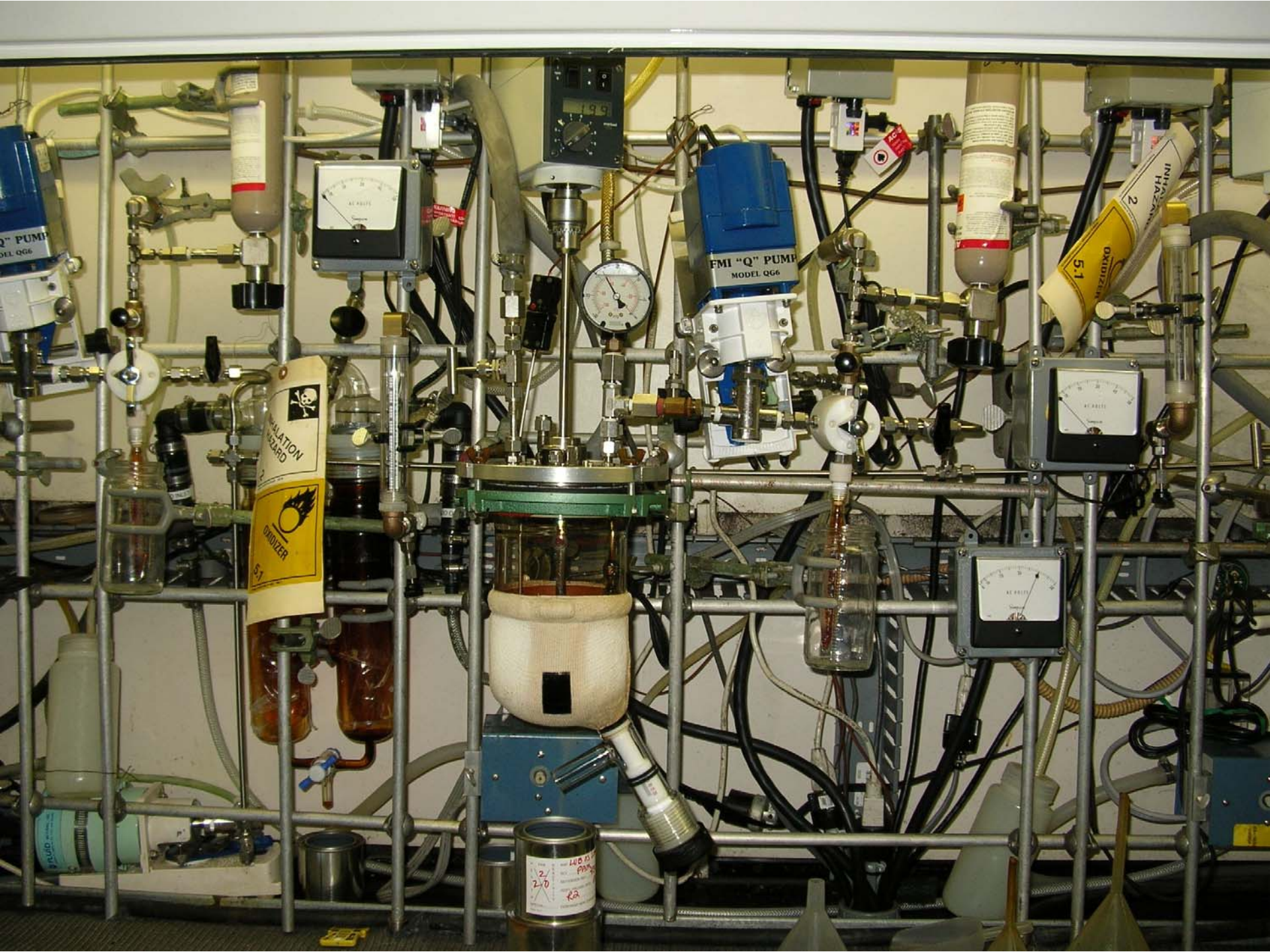
Replace Sequence IIIGA aging for used oil pumpability measurement by MRV

ROBO Timeline

- **'03** - Test development started
- **'05** - Main elements of test in place
- **December '06** - ASTM TF created
- **February '07** - Appears on ILSAC GF-5 draft specification replacing Sequence IIIGA
- **Autumn '08** – ASTM ballot and completion of round robin
- **??** – ASTM Method

ROBO

Ingredient	Engine simulation	Effect	“Amount”
Test fluid	Lube oil	Substrate for reaction	200 grams
Iron ferrocene	Wear metals	Catalyst	15 PPM
Nitrogen dioxide	Blow-by gas	Catalyst	2 ml / 12 hours
Dry air	Air	Oxygen source	185 ml / minute
Agitation	Churning	Mixing	200 RPM
Vacuum	Volatility in engine	Removal of oil light ends	0.61 Barr 56.6 L/min
Temperature	Operational condition	Reaction driver	170 °C
Time	Drain interval	Sufficient reaction time	40 Hours



FMI "Q" PUMP
MODEL Q66

FMI "Q" PUMP
MODEL Q66

RESPIRATION HAZARD
OXIDIZER
5.1

OXIDIZER
5.1

2/20
RA

ROBO

Vetting Data

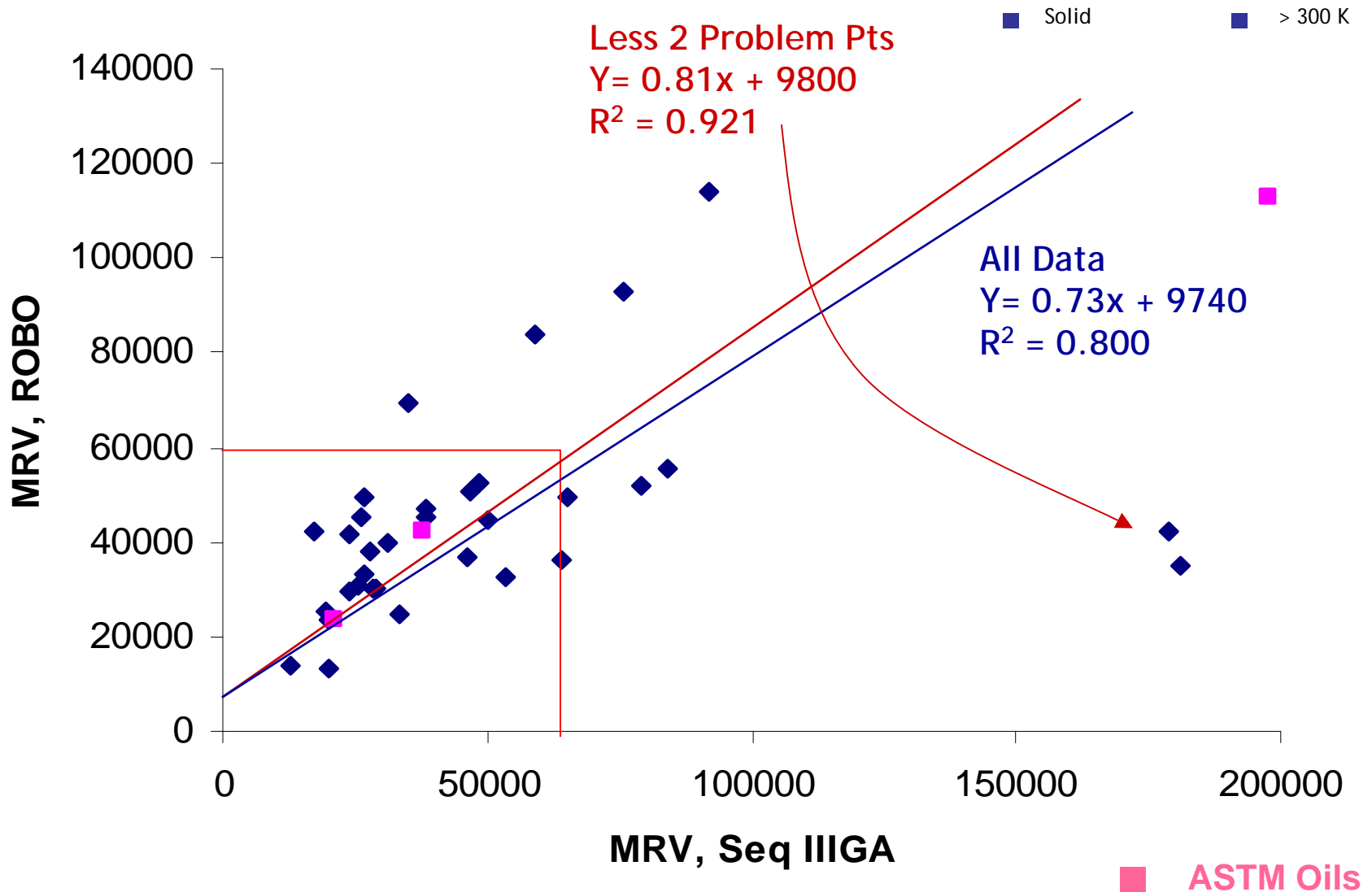
1. Three ASTM Sequence IIIG matrix oils were used to setup ROBO conditions and correlate ROBO to the Sequence IIIGA engine procedure
2. Thirty five ILSAC GF-4 type oils from various sources, primarily American Chemistry Council members, have been ROBOed for viscosity increase

Measurements after ROBO

- MRV by D 4684
 - Used Oil Pumpability
- pVis [Δ KV40] by D 445
 - Mimic Sequence III G
- CCS by D 5293
 - SAE W grade to set MRV temperature
- Volatiles – gravimetric
 - Mimic Sequence III GA

MRV Data and Correlation

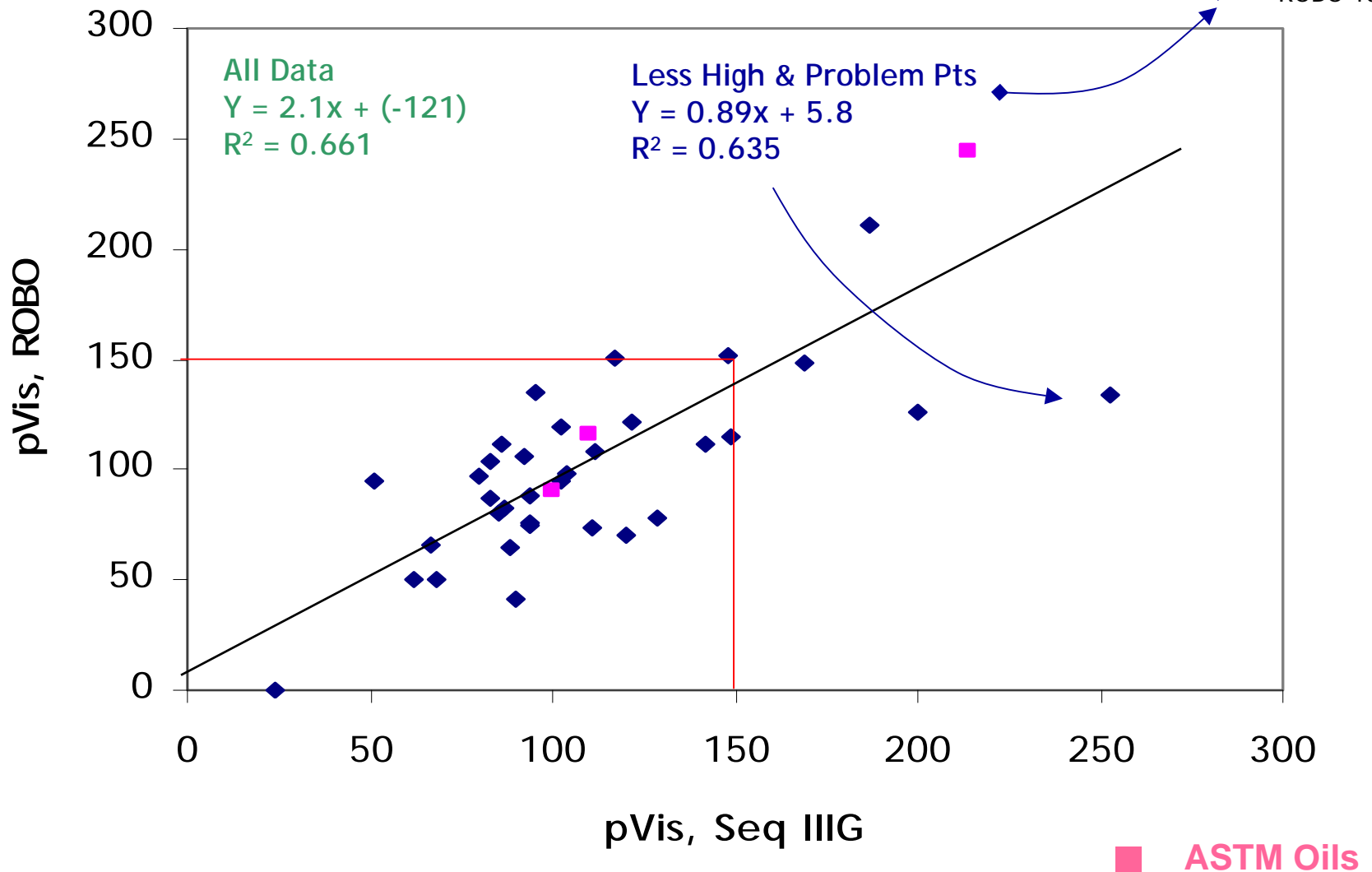
35 GF-4 Type Oils and 3 ASTM Matrix Oils



pVis Data and Correlation

35 GF-4 Type Oils & 3 ASTM Matrix Oils

Eng 384
ROBO 1077



ROBO

Data Summary

Category Prediction Analysis

- | | <u>MRV</u> | <u>pVis</u> |
|----------|---------------|---------------|
| – Totals | 31 / 38 - 82% | 33 / 38 - 87% |
- Some near misses
 - MRV - 2 near misses - include these 2 - 87%
 - KV40 - 3 near misses - include these 3 - 95%
 - Two problem points - different Seq IIIGA and ROBO results – SAE 5W-30 & SAE 10W-30
 - No clear explanation - single Sequence IIIGA data point an issue?

ROBO

Other Experiments

- Biases – none detected with
 - Different DIs
 - Different VIIs
 - ILSAC SAE viscosity grades
 - Low to high VII treat rate
- Pre-shearing – no effect detected
- Key variables study

ROBO Status I

- Capable labs
 - Seven labs [of seven providing data] were ‘certified’ to participate in round robin
 - Match viscosity [MRV and pVis] guidelines based on Seq III GA matrix results
- Round Robin
 - Seven labs & ten stands – 30 df
 - Seven test oils run in duplicate
 - Essentially complete - 132 results from 140 planned tests [94%]
 - A few missing results / a few invalid runs
 - ASTM TMC statistical analysis complete
 - Precision better than Seq III GA
 - Ranks Sequence III GA matrix oils appropriately

ROBO Status II

- Written method
 - ASTM facilitator suggestions largely incorporated
 - Precision statement being incorporated
 - Research report being written
 - TMC monitored test
- Ballot
 - Informal ballot within ROBO Task Force next week
 - TF meeting and discussion – Next Week
 - Formal ballot to ASTM Nov 3
 - ASTM D.02 Sub Committee B level
 - Ballot to close on Dec 5
 - Discussion / adjudication - December Tampa meeting
 - Main Committee D.02 ballot – February?

Go Phillies