ISM Status

Presentation to
HDEOCP
David M Stehouwer
February 23, 2005

David M Stehouwer, Cummins Inc.

Brief overview of status of Test Development

- Matrix testing complete
- Initial matrix analysis complete
- Discrimination demonstrated on wear, and filter plugging.
- Sludge deposits also measured as part of the test
- Recommendation was made to HDEOCP that the test does show discrimination and that several other items such as outliers, soot correction, etc. would be soon finalized

January ’05 meeting

- In January the panel met to try and resolve the pending items such as
  - Outlier screening
  - OFDP calculations
  - Soot corrections
  - M11EGR / HST correlations
  - Redundant parameters
  - Transforms

ISM Status

- ISM ready to carry forward for PC10
- As a guideline for formulators: Performance of PC 10 candidates should be equal to or better than 830.
  - ü A Merit system is also being considered
  - ü Limits for backward compatibility will be discussed at March 22 meeting
- OEM feels that ISM should have soot correction
  - ü Historically all the M11 tests have needed correction
  - ü Data over broad range supports correction
  - ü Presentation by Chevron Oronite

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Wear Normalization for Soot in the Cummins ISM Test

- **Soot impact significant for XHW and IASW**
  - ü Average soot range 3.4 to 4.3 %
  - ü True for complete data set w or wo outlier screening
  - ü True for complete data set w or wo outlying test
- **Soot impact trend for reduced data set with higher soot window tests**
  - ü Average soot range for smaller reference test data set 3.7 to 4.3 %
  - ü Range too small to reveal a significant soot impact
- **M11 engine tests have always had a soot normalization**
  - ü ISM is the same basic engine
  - ü ISM soot normalization necessary for establishing M11EGR/ISM correlation
  - ü Average soot range can range from 3.7 to 4.5 %
- **Recommendations**
  - ü Apply a normalization for XHW (linear) and IASW (exponential)
  - ü Adopt a 50 h soot window

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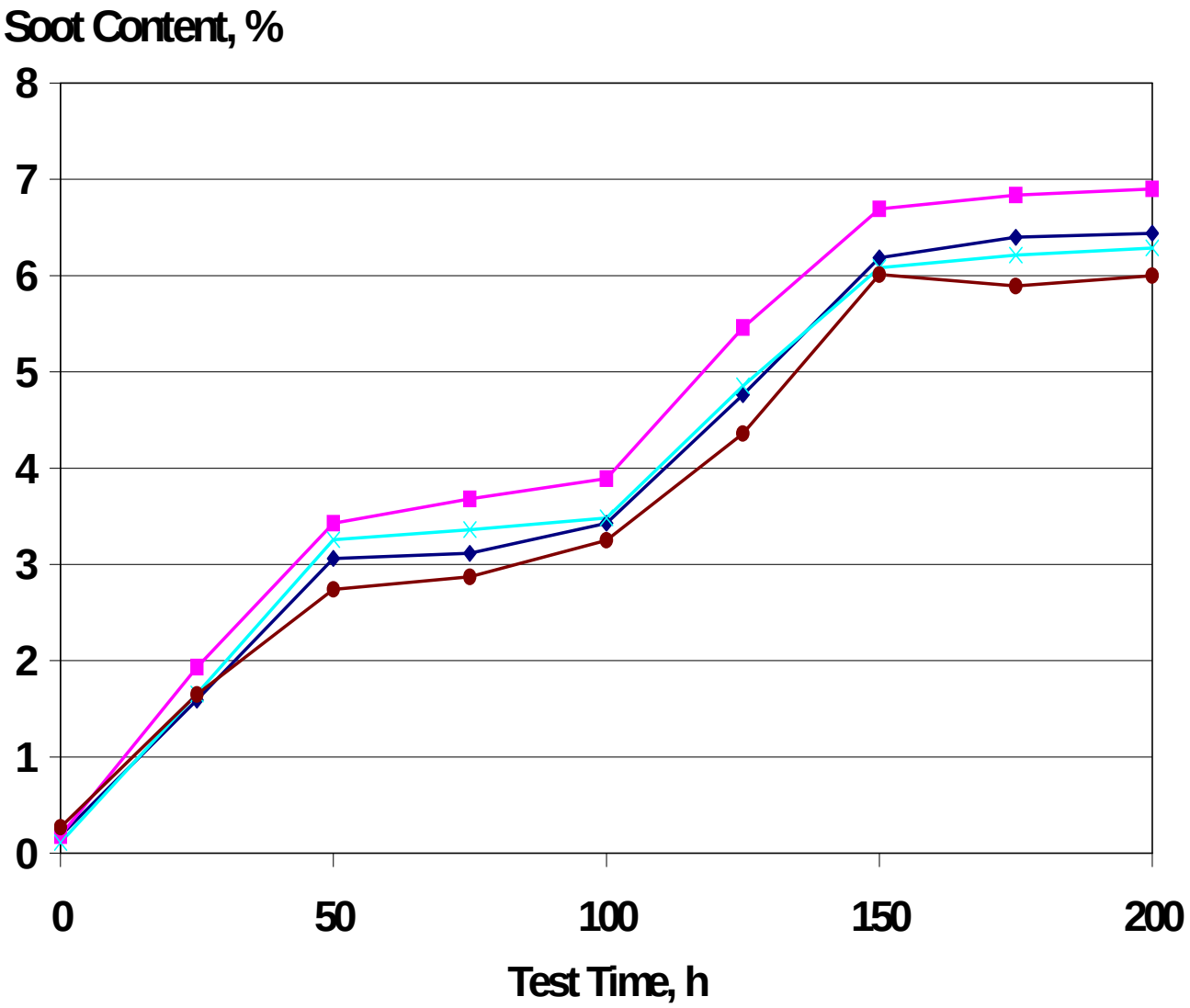

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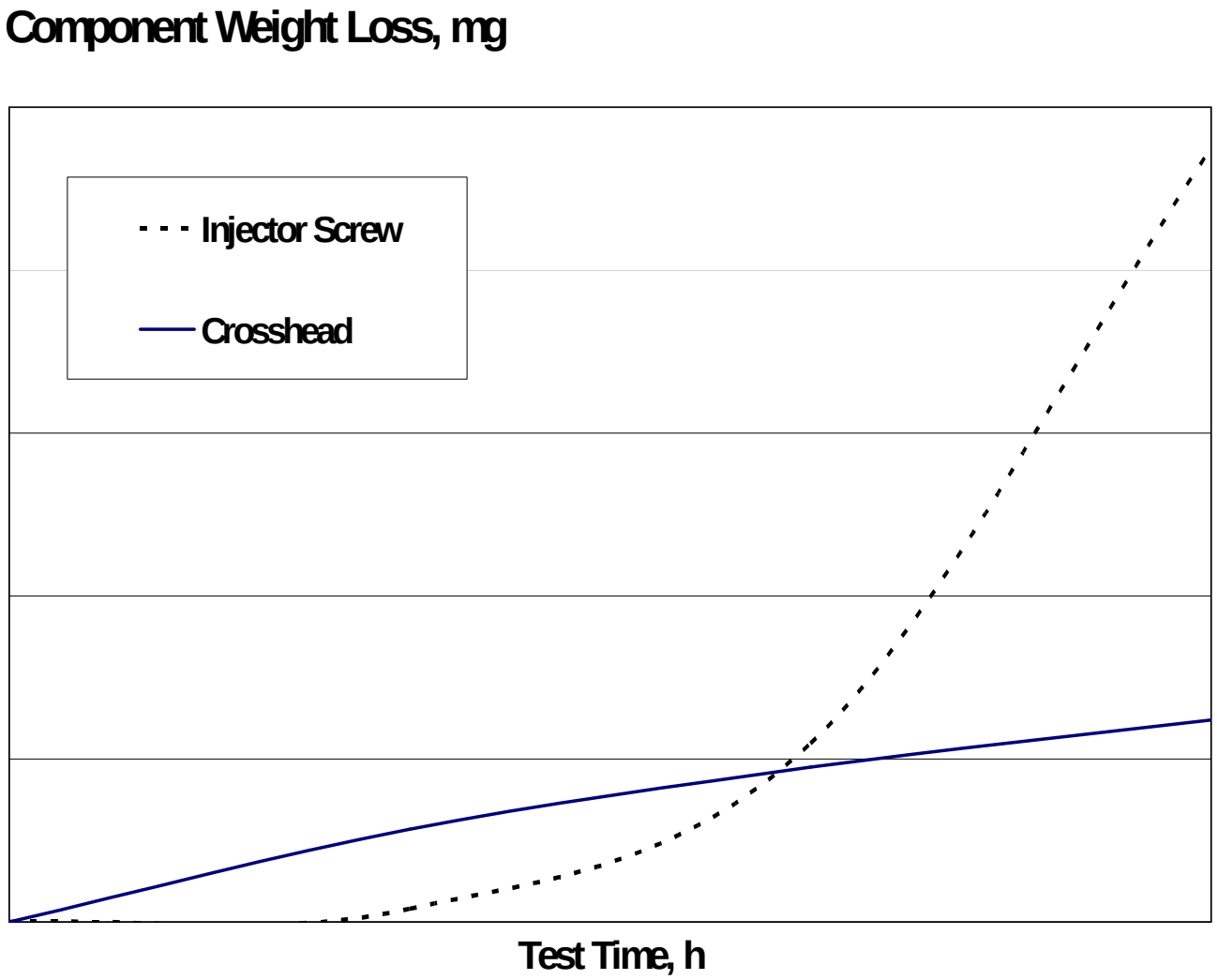
Wear versus Time
Linear for XHW and Exponential for IASW



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Current timing for the ISM Development

- **3/22/05 -- Discuss Reference status of stands**
- **3/22/05 – M11EGR correlation**
  - ü **TMC to solicit data as a neutral party?**
  - ü **Data to TMC by 3/14**
- **5/05 – Test procedure issued**
- **6/05 – Initial development complete – ISM to be monitored by the Surveillance Panel and task force disbanded.**

ISM Action Items

- **TMC to solicit data to help establish ISM / M11 EGR correlation**
  - ü Due to TMC for distribution to Task Group by March 14
- **Task Group meeting in Columbus March 22.**
  - ü Examine matrix data with and without soot correction
  - ü Recommend limits for M11 EGR correlation to HDEOCP
  - ü Resolve stand calibration issues

ISB Status Report

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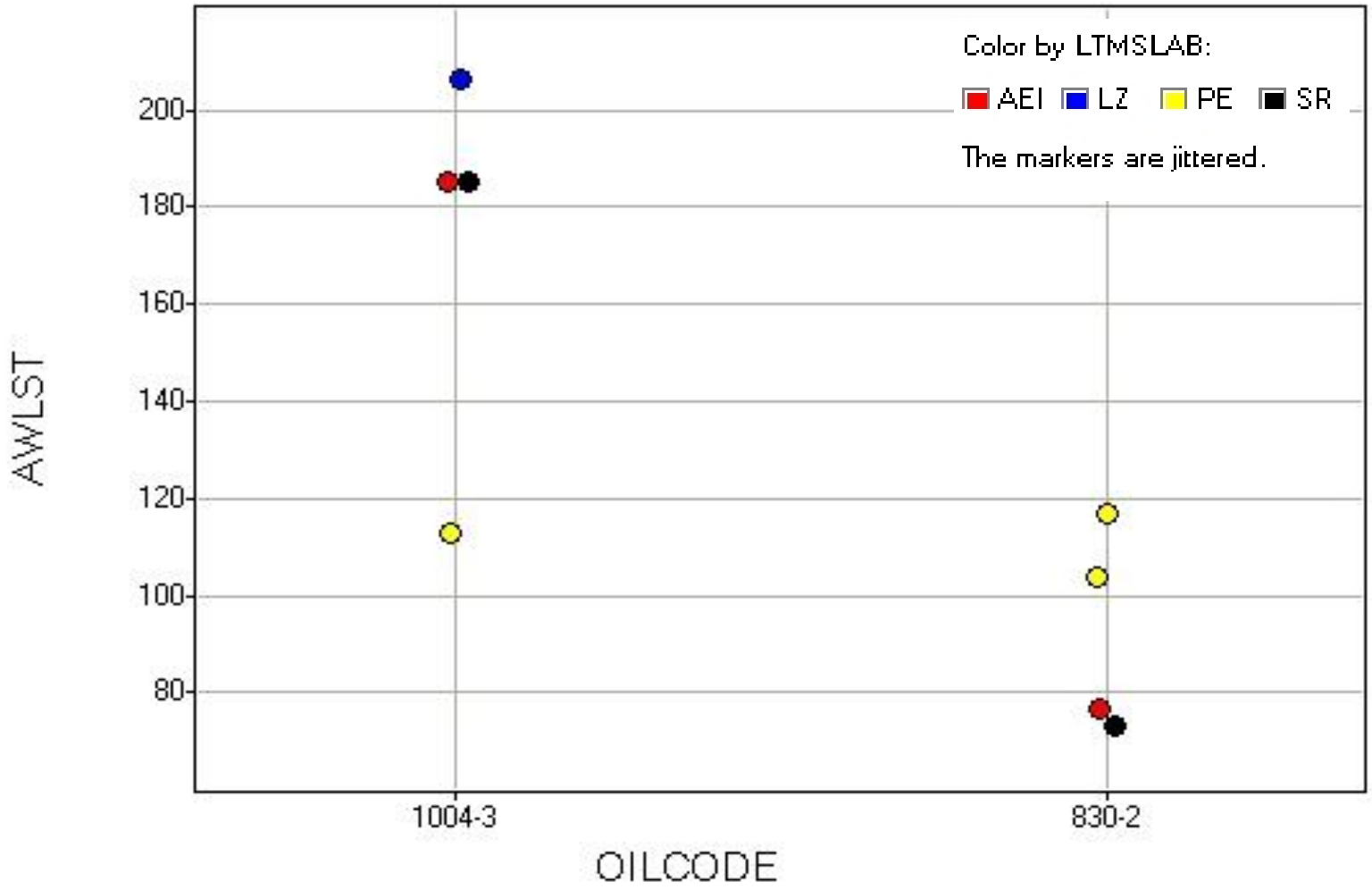
ISB Status

- **Severity issues at one lab were linked to a control problem and exhaust back pressure issues.**
  - ü Source was identified
  - ü Corrective action is in place
  - ü Another run is planned
- **Build workshop was held Feb 8, 9**
  - ü Several issues identified and addressed in Task Group
  - ü Evaluate use of longer cam pin
    - ð Decrease ADCOLE measurement time (48 hr turn around)
- **Draft 1 Procedure completed**
  - ü Task Group reviewing
  - ü Incorporating details from build workshop

ISB Engines at Labs

- SwRI @ San Antonio, Completed 830-2 and 1004-3
- PE @ San Antonio, Completed three 830-2 and one 1004-3
- Lubrizol @ Wickliffe, Completed 1004-3 one 830-2 pending
- ExxonMobil @ Paulsboro, Preparing to Run Reference Oil
- Valvoline, Ashland, May Run Older Engine Configuration
- Afton, Richmond, Waiting on Engine, Waiting on Cell Space

Tappet Wt Loss



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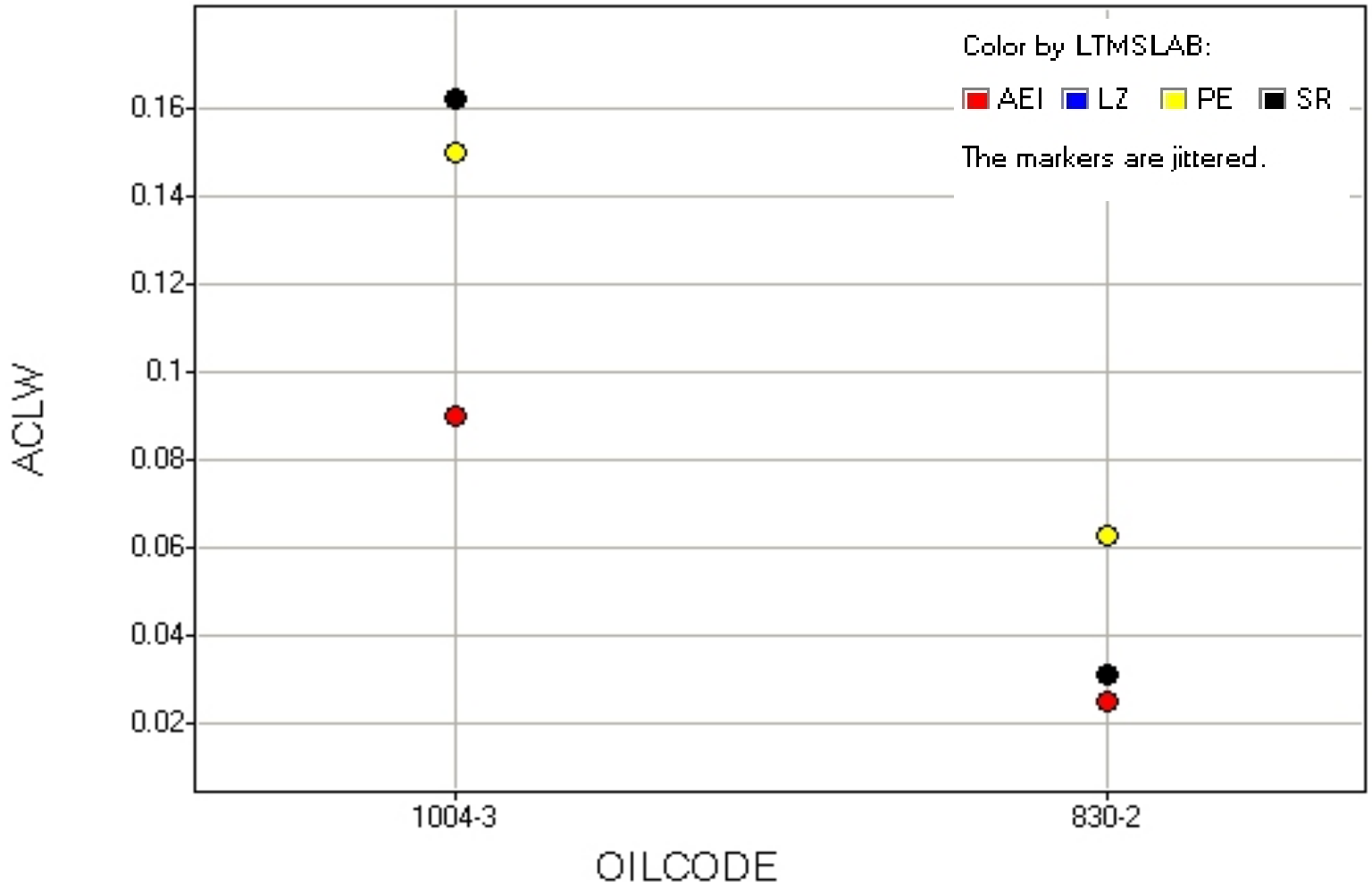
Cam Lobe Wear



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ISB Action Items

- **Motion from CSP: ISB Test should use dyed low S PC-10 fuel.**

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