Mack T10 Limits
An alternate proposal

Mack T-10

- **Proposed pass limits are significantly more severe than the average performance of the featured oil**

- **Of 27 matrix runs 5 runs would 'pass' out of 27**
  - **Only 2/10 runs on the 'featured' oil pass the requirements**
  - **5/20 for 'PC-9' level matrix oils**

- **Following parameters result in the most difficulty**
  - **Liner wear**
  - **Lead increase (either EOT or last 50 hour)**

- **Precision of parameters results in frequent 'random' failures of a very expensive engine test**

- **What would be required if Oil A were to Pass 50%, 75% and 95%?**

Criterion	Mack Limit	Oil A LS Mean	75% Pass	95% Pass
Liner Wear	30	34	37	41
Top Ring Weight Loss	140	133	150	174
EOT Lead Delta	30	24	30	39
250-300 Hour Lead Delta	10	10	14	20
Average Oil Consumption	60	53	59	67
EOT IR Oxidation	750	407	530	705

- *Is there a better alternative that insures high performance oils but reduces repeat testing due to test variability?*

- **Utilizing statistically merit system should be considered as an alternative**
  - **Combined with 'fail safe' limits**
  - **Biased to the OEM desired limits**
  - **Accounts for test precision**

- **Goals for an appropriate merit based system**
  - **Based on test statistics**
  - **Clearly discriminate between PC9 and non-PC9 chemistry**
  - **Combine a merit rating with 'hard' limits which represent the point beyond which an oil is statistically beyond the desired performance envelop**
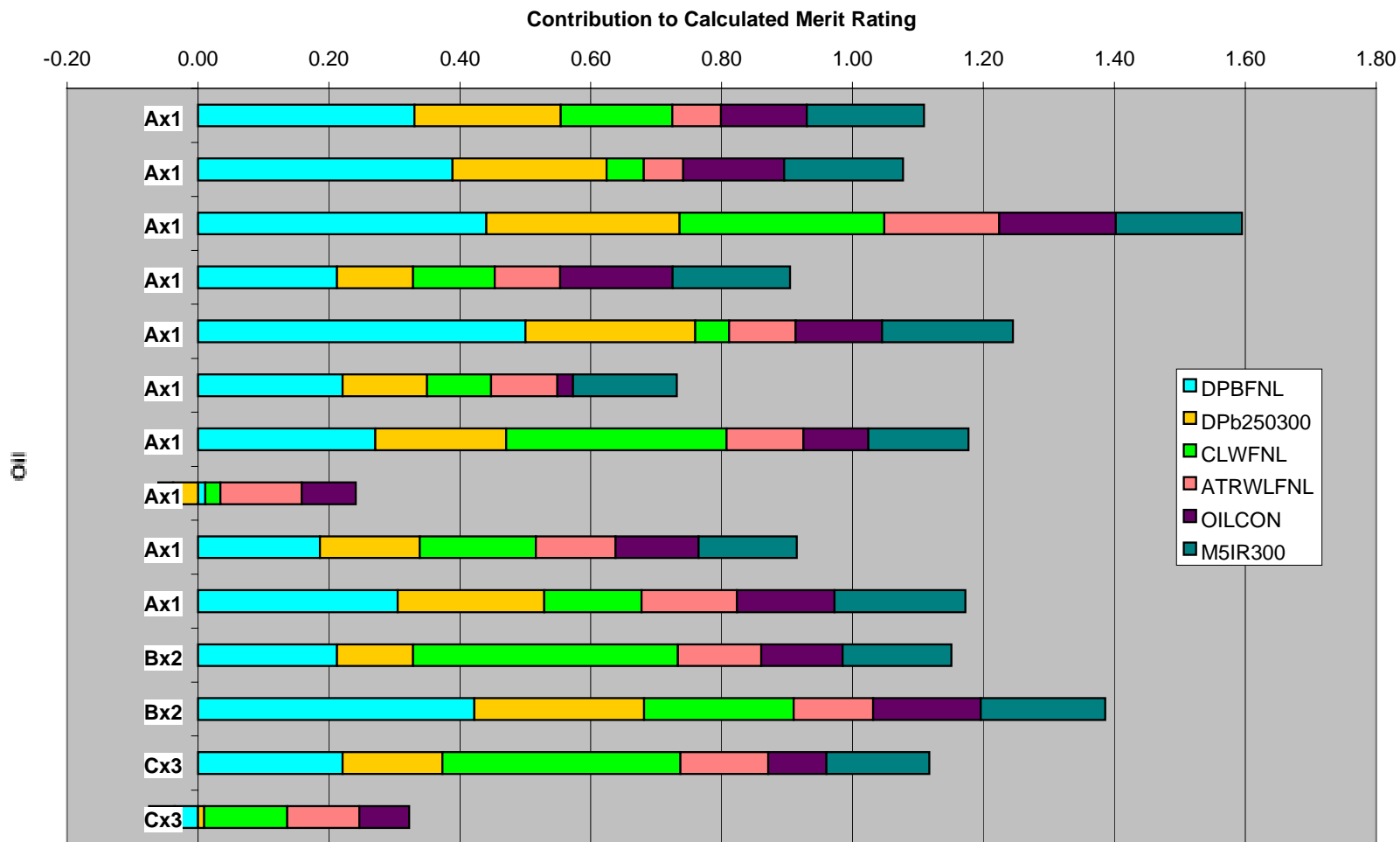
Chevron Oronite Technology - Richmond, CA

- **How to interpret the following charts**
  - **Assumptions for weighting of parameters:**
    - » EOT Pb: 25%
    - » 250-300hr Pb: 20%
    - » Liner wear: 25%
    - » Ring wt. Loss, Oxidation, Oil consumption all 10%
  - **Allows ±2SD from center**
  - **Exceeding the deviation limit defines a fail**
  - **Exmple uses the Mack proposed limits as anchor point**
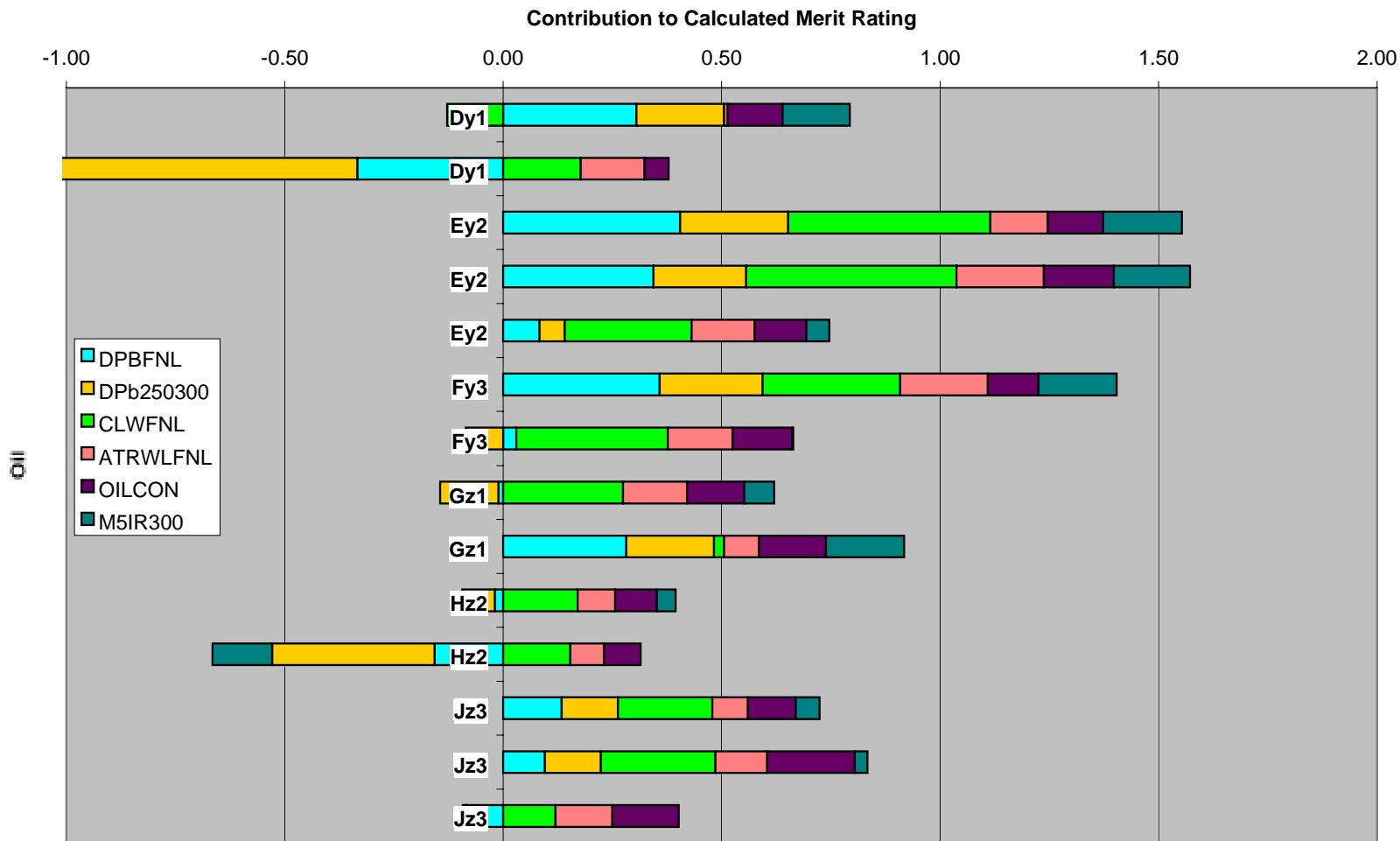
Example: Based on Mack proposed limits

Wide Merit Rating for Technology X Oils

Example: Based on Mack proposed limits

Wide Merit Rating for Technology Y & Z Oils

Contribution to Calculated Merit Rating

Legend:
- DPBFNL
- DPb250300
- CLWFNL
- ATRWLFNL
- OILCON
- M5IR300

Oils: Dy1, Dy1, Ey2, Ey2, Ey2, Fy3, Fy3, Gz1, Gz1, Hz2, Hz2, Jz3, Jz3, Jz3

- **Clearly discriminates oil performance while accounting for test variability effects**
  - **Example 1:**
    - » PC9 technology combined (X and Y) 'passes' 70% of the time
    - » CH-4 technology 'passes' 28% of the time
  - **Example 2**
    - » PC9 technology combined 'passes' 57% of the time
    - » CH-4 technology 'passes' 0%

- **We believe that adoption of this system would reduce concerns about the impacts of precision of the individual parameters**