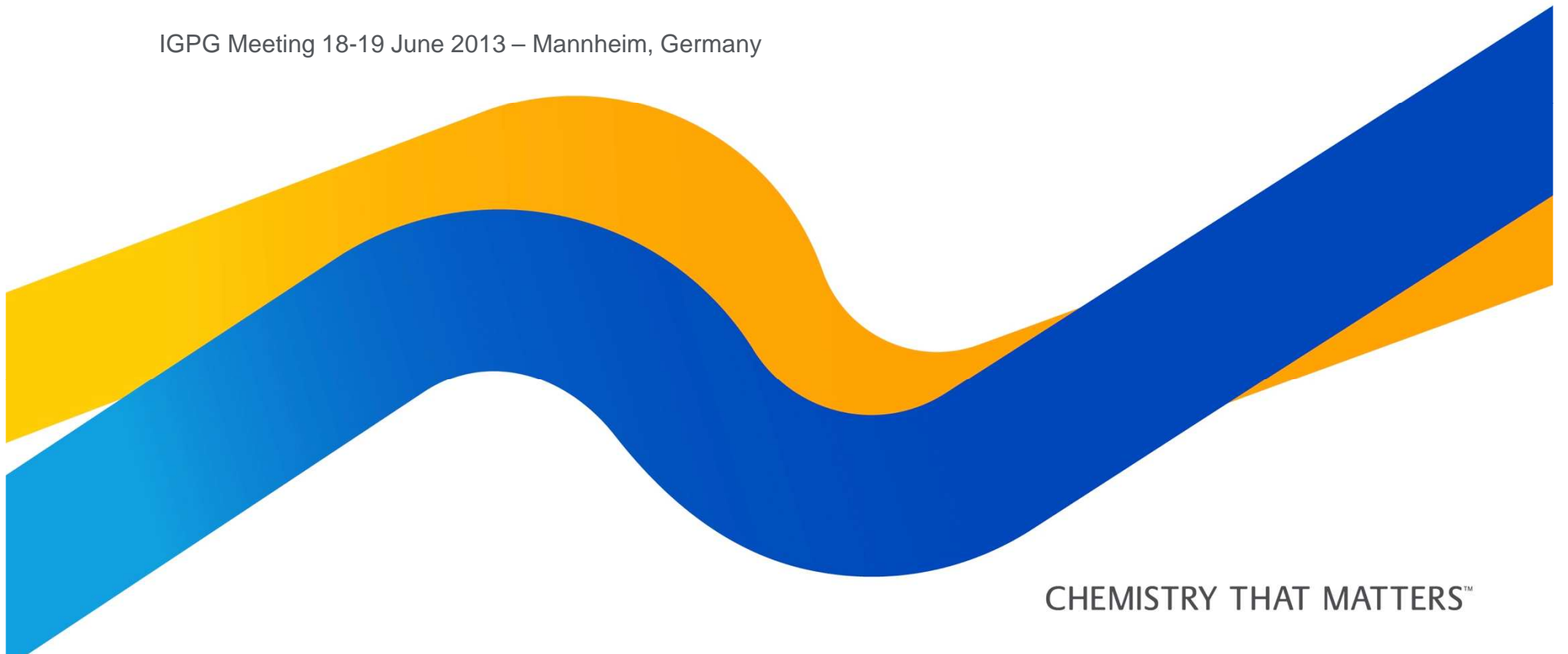




IGPG SG2 – Accelerated Wiper Testing

June 2013 SG2 meeting update

IGPG Meeting 18-19 June 2013 – Mannheim, Germany



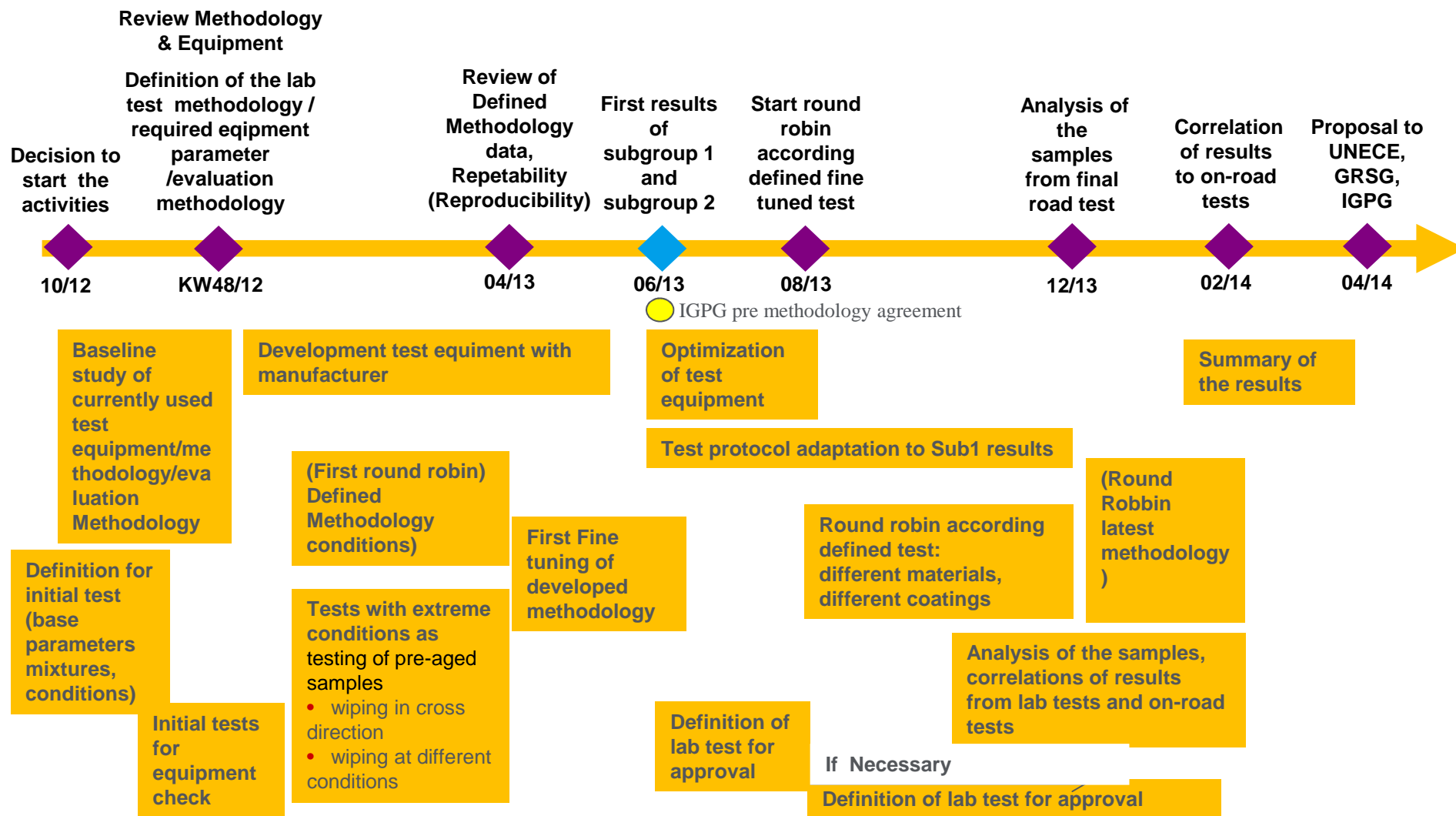
CHEMISTRY THAT MATTERS™

IGPG-SG2 ACCELERATED WIPER TESTING

SG2 TARGET:

- ✓ Define principle test setup/test machine
- ✓ Define procedure / test protocol
- Propose an evaluation methodology
- Check Repeatability and reproducibility
- Correlate with Subgroup I - onroad results

IGPG-SG2 ACCELERATED WIPER TESTING



IGPG-SG2 ACCELERATED WIPER TESTING

MEETING HAD IN DARMSTADT W48/2012

- Feed back on preliminary test result carried on some equipment
- Reviewed Methodology & Equipment based on questionnaire feed back from Bayer, Bosch, BYK, Evonik, Momentive, PSA, Renault, SABIC, Valeo
- Defined wiper lab equipment / wiper test methodology / main protocol /evaluation methodology, with identification of main “extreme condition” protocols
- Reviewed planning from 11/12 to 04/13

IGPG-SG2 ACCELERATED WIPER TESTING

Reviewed Methodology & Equipment based on questionnaire feed back from Bayer, Bosch, BYK, Evonik, Momentive, PSA, Renault, SABIC, Valeo

Questionnaire feed back on below main topics:

- Available test equipments
- Wiper blades
- Mud/Mixture
- Protocols (Load, velocity, test cycle, flow rate, samples...)
- Evaluation methodology
- Comparison with real data

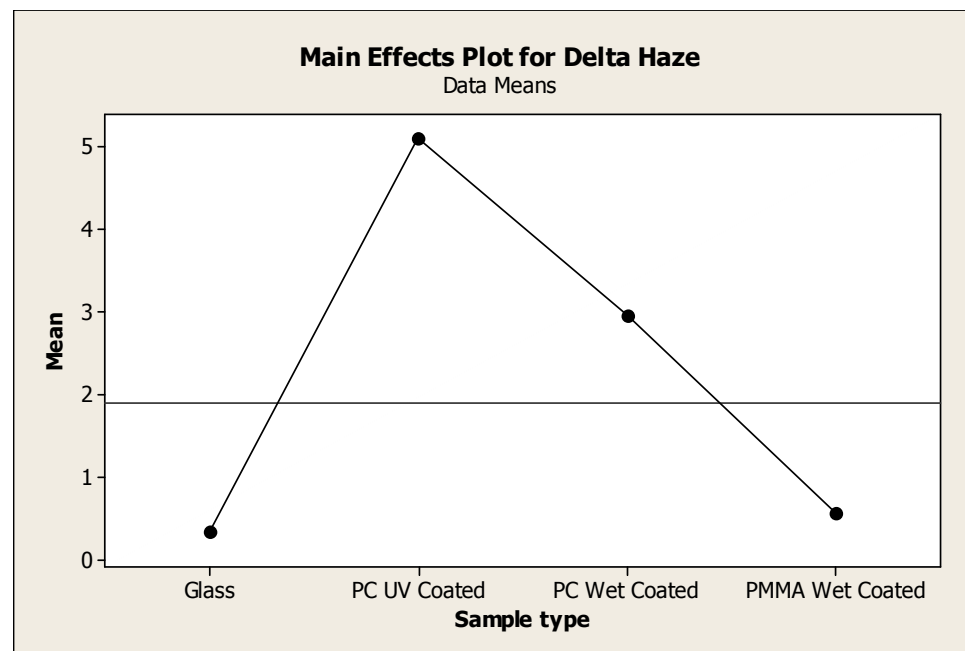


IGPG-SG2 ACCELERATED WIPER TESTING – PROCESS

- ❑ Each sample was measured in 9-12 locations depending on the size of the sample
- ❑ Analysis Tools were percent change in haze and percent change in clarity
- ❑ Samples were measured on both exposed and unexposed sides
- ❑ Five different test methods were used
 - A. Wet with Bath for 25,000 cycles. Tested by Bayer, Bosch, Evonik, and Momentive.
 - B. Wet with Slurry Flow for 25,000 cycles. Tested by SABIC
 - C. Dry for 1,000 cycles. Tested by Bayer, Bosch, Evonik, and Momentive.
 - D. Continuous Protocol: 10 dry cycles, 20 wet cycles, 6 seconds off, repeated up to 25,000 cycles. Tested by SABIC
 - E. Wet with Bath for 25,000 cycles then dry for 1,000 cycles (A + C). Tested by Bayer, Bosch, Evonik, and Momentive

IGPG-SG2 ACCELERATED WIPER TESTING – RESULTS

- ❑ Analysis based on Delta Haze on exposed side of sample.
- ❑ Without taking interactions into account, including all test methods and labs, there appears to be a visible difference between sample types.



NOTE: Wet coated PC samples must be retested due to an expected error in coating application of original samples.

IGPG-SG2 ACCELERATED WIPER TESTING – RESULTS

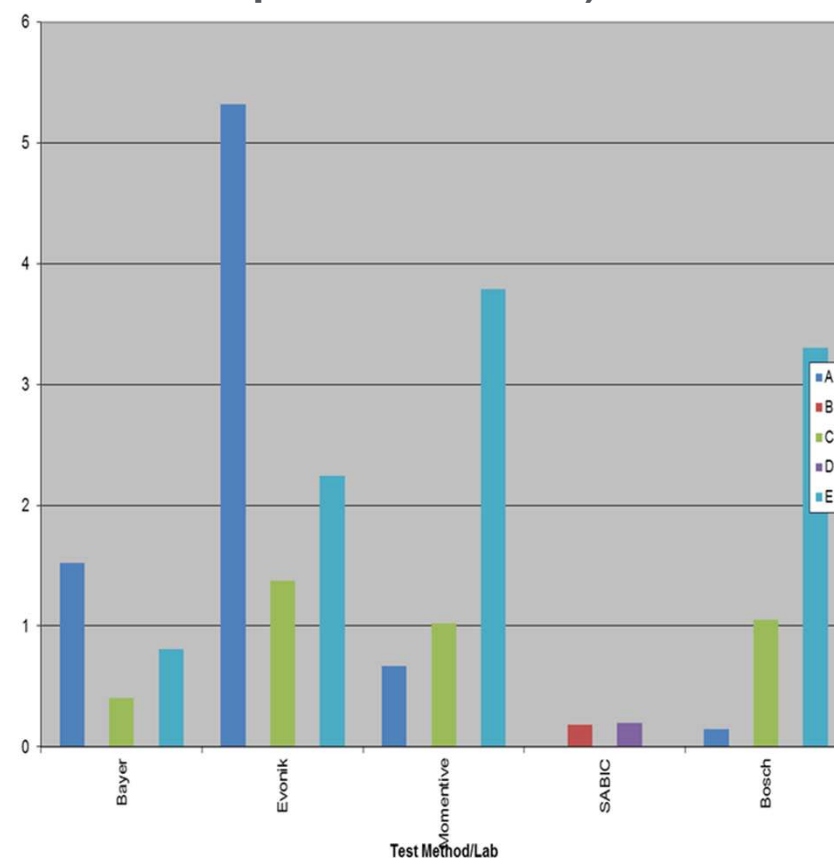
Results per test method:

- A. One of the test labs showed high variability in comparison to the other labs. Retesting is in progress.
- B. No statistical difference was between the materials and not noticeable using delta haze. All mean results were less than 1%.
- C. There is a statistical difference between materials, but no statistical difference between the laboratories (possibly due to the variability in the test and samples). Variability is the same for all labs used.
- D. Results appear most consistent when reviewing the standard deviations per material.
- E. Not enough samples were tested to show the repeatability or reproducibility of this method.

IGPG-SG2 ACCELERATED WIPER TESTING – CONCLUSIONS

- ❑ There is high variation in all tests except for Test D.
- ❑ There is low variation in Test A only specific to one test lab.
- ❑ In order to really understand if the values are real, we need to increase the sample size to possibly 10. 3 samples may not enough based on the variation that is present in these tests.
- ❑ Using another analysis tool may provide better insight to the difference in samples, labs and protocols that haze cannot provide.

**Sample Variation / Standard Deviation
(including all samples tested per protocol and lab)**



IGPG-SG2 ACCELERATED WIPER TESTING – PATH FORWARD

As agreed based on the results we will perform a second quick round test as following:

Procedure **A** Sample PC Wet Coated Laboratory Bayer, Bosch, Evonik, Momentive

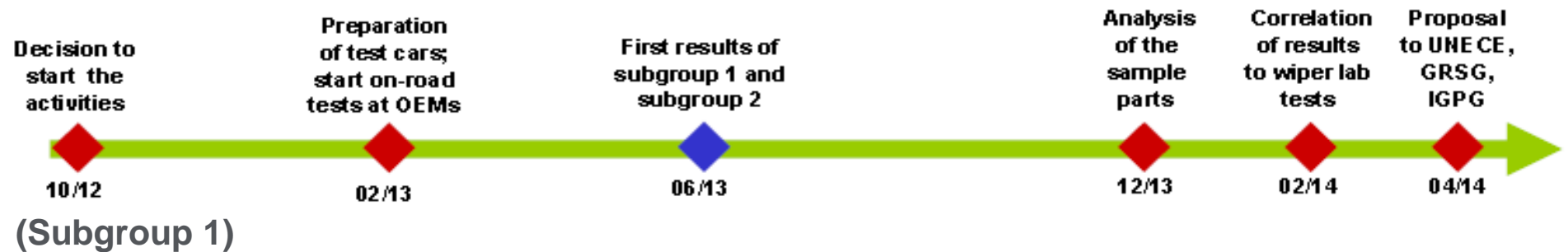
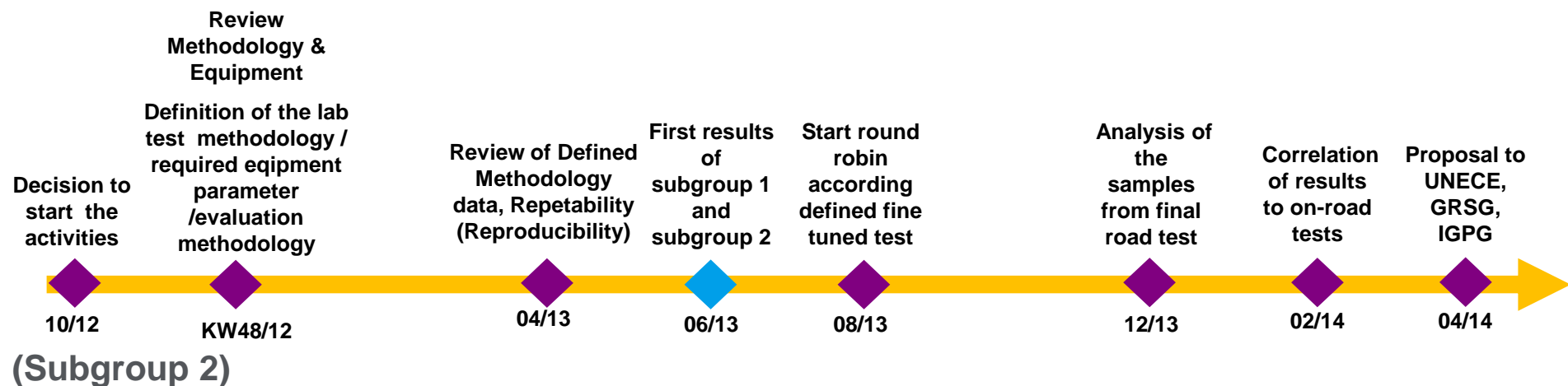
Procedure **A_Low** (test at lower speed) Sample PC Wet Coated Laboratory Bayer, Bosch, Evonik, Momentive

Procedure **D** Sample PC Wet Coated Laboratory SABIC

Procedure **D_Low** (test at lower speed) Sample PC Wet Coated Laboratory SABIC

Will be tested N° 3 sample for each protocol/laboratory.

IGPG-SG2 ACCELERATED WIPER TESTING



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