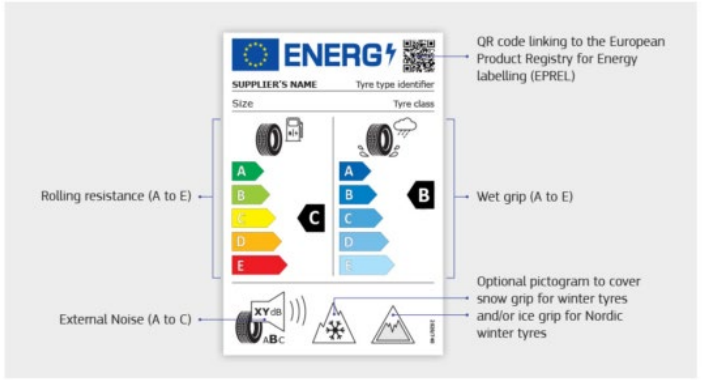
Belgian Road Research Centre
Together for sustainable roads

RESEARCH MEETS INDUSTRY

Informal document GRBP-76-26
Agenda item 6

Uncertainty on the EU Tyre (Noise) Label

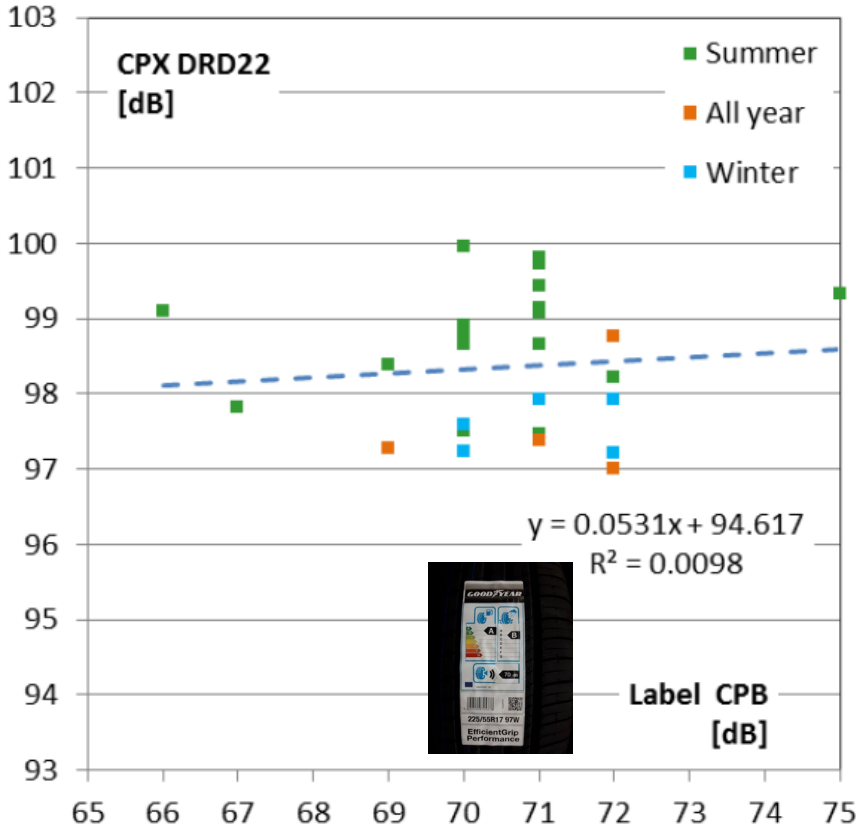


Luc Goubert, Belgian Road Research Centre

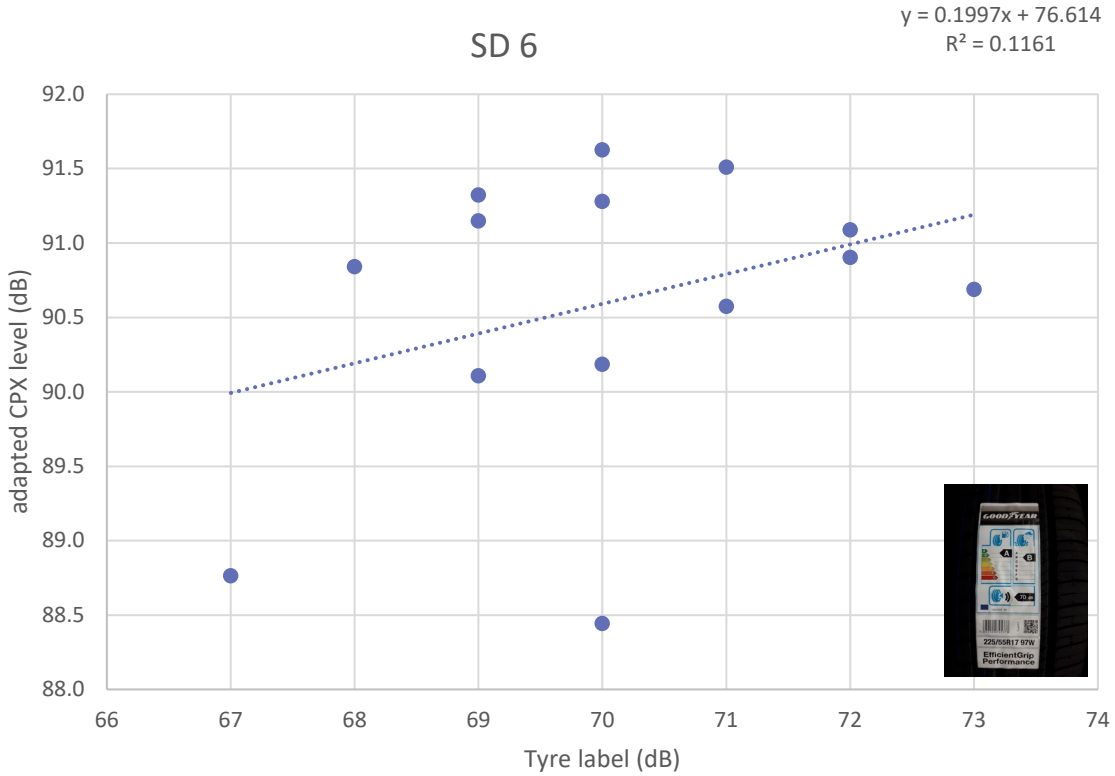
76th meeting of GRBP - UNECE

Geneva, Palais des Nations, 5-7 September 2022

Correlation between the tyre noise label and real life…



Kragh, J. et al. (2015): NordTyre – Tyre labelling and Nordic traffic noise – Analysis of data on passenger car tyres. Report No.2018-1 NordFOU, 30 Nov.2014, revised June 2015

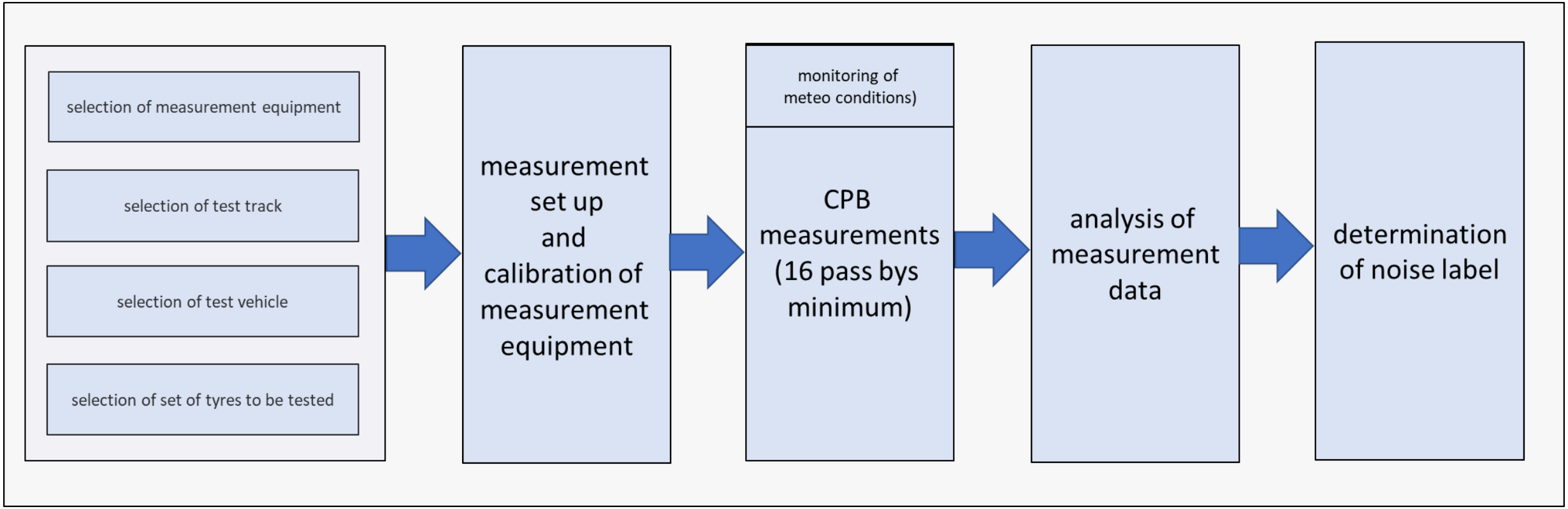


Hammer, E. and Bühlmann, E. (2018):
The noise reduction potential of "silent tyres" on common road surfaces, Proceedings of Euronoise 2018, Crete

What is going wrong and how to fix it?

- CEDR-project: **STrengthening the Effect of quieter tyres on European Roads (STEER)**
- 1 December 2019 – 31 December 2021
- Consortium:
  - Grolimund & Partner (CH, coordinator)
  - VTI (S)
  - BRRC (B)
  - Sintef (N)
  - Nokian Tyres (SF)

Regulation No 117 of the Economic Commission for Europe of the United Nations (UNECE)



Regulation No 117 of the Economic Commission for Europe of the United Nations (UNECE)

Regulation No 117 (UNECE):

- Controlled Coast By-method
- (smooth) ISO 10844 test track
- Test vehicle equipped with 4 tyres to be tested
- Two sided measurements
- At least 16 runs

Uncertainty analysis

- 41 "sources of uncertainty" identified in whole procedure, classified in 8 categories
- Analysis complying with GUM*

Category name	Category #
Equipment	1
Experimental set up	2
Measurement conditions	3
Measurement	4
Test vehicle	5
Test track	6
Test tyres	7
Calculation	8

*ISO/IEC Guide 98-3:2008 (E) Uncertainty of measurement Part 3: Guide to the expression of uncertainty in measurement (GUM: 1995)

Uncertainty contribution from the test track

- ETRTO[1]: 0,92 dB
- M+P: "old" RRT of 2005[2]: max-min difference about 4 dB
- Recent Swiss study[3]: 1,3 dB
- Expert vision within consortium: about 1 dB

[1]ETRTO, 2019. Tyre noise uncertainties in UN Regulation No. 117,
Presentation at 2nd Meeting of GRBP Task Force MU, Brussels, 28-29 November 2019.
[2]Van Blokland, G., Peeters, B., 2006. Comparison of surface properties of ISO 10844 test tracks.
[3]Bühlmann, E., Schlatter, F., Sandberg, U., 2021.
Temperature influence on tire/road noise measurements:
Recently collected data and discussion of various issues related to standard testing procedures.
Proc. INTER-NOISE 2021 - 2021 Int. Congr. Expo. Noise Control Eng. https://doi.org/10.3397/IN-2021-1830

Uncertainty contribution from the test tyres

- Sample to sample variations: 0,26 dB[1] up to 0,42 dB[2]
- "Tyre family" effect: 0,59 dB up to 1,1 dB[3]

[1]ETRTO, 2019. Tyre noise uncertainties in UN Regulation No. 117,
Presentation at 2nd Meeting of GRBP Task Force MU, Brussels, 28-29 November 2019.
[2]STEER analysis from the data base from a tyre manufacturer
[3]Swedish-Polish study carried out in the margin of STEER project (see § 4.2.5 of STEER Final Report)

Uncertainty contribution from the test vehicle

- ETRTO[1]: 0,51 dB
- STEER analysis[2]: 0,60 dB

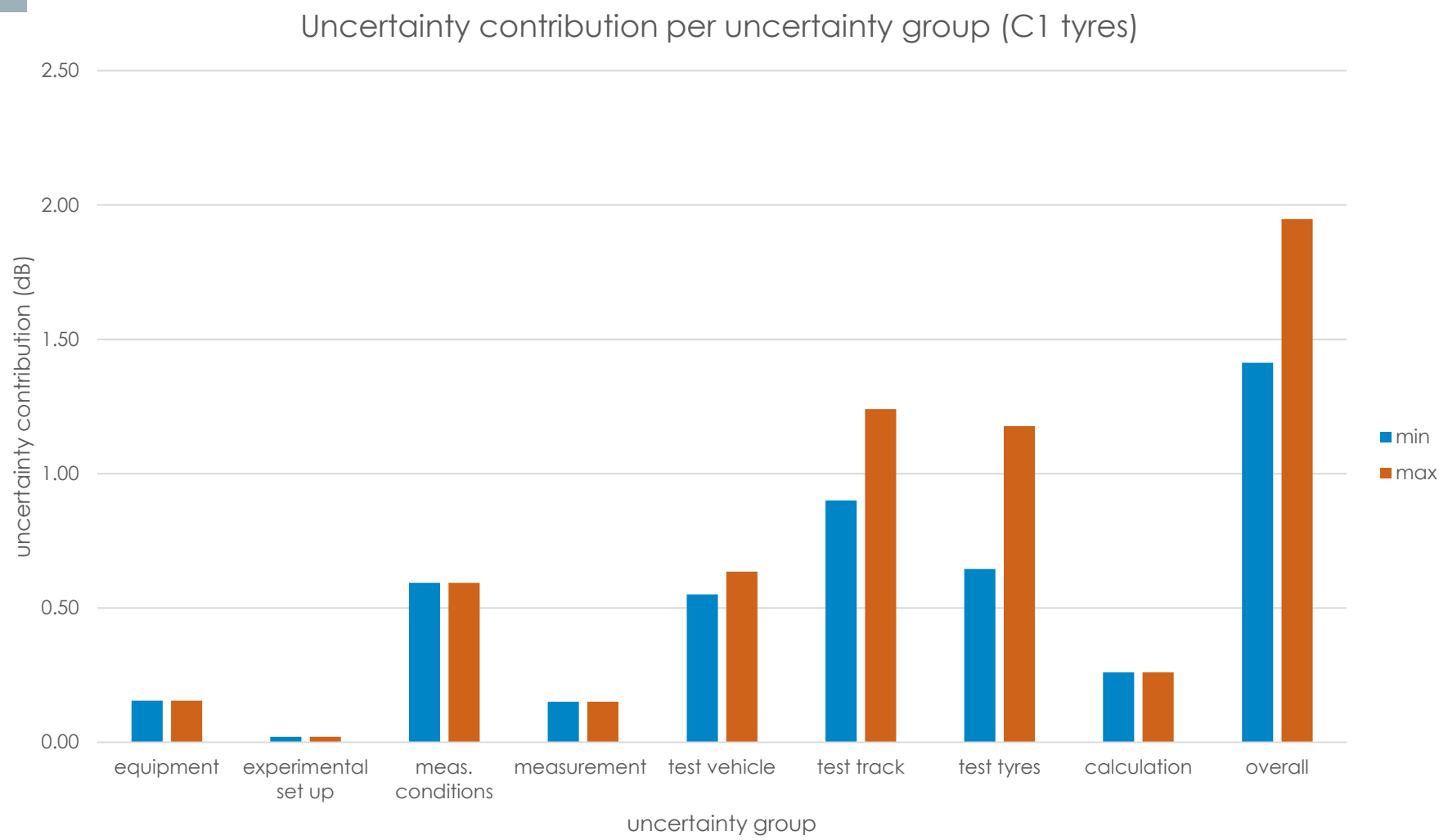
[1]ETRTO, 2019. Tyre noise uncertainties in UN Regulation No. 117,
Presentation at 2nd Meeting of GRBP Task Force MU, Brussels, 28-29 November 2019.
[2]extracted from the data base from a tyre manufacturer

Uncertainty contribution from the measurement conditions

- Main uncertainty contribution is from the temperature correction: 0,59 dB[1]

[1] § 3.3.7 of STEER Final Report

Uncertainty analysis: results



Improving the test track: calibration?

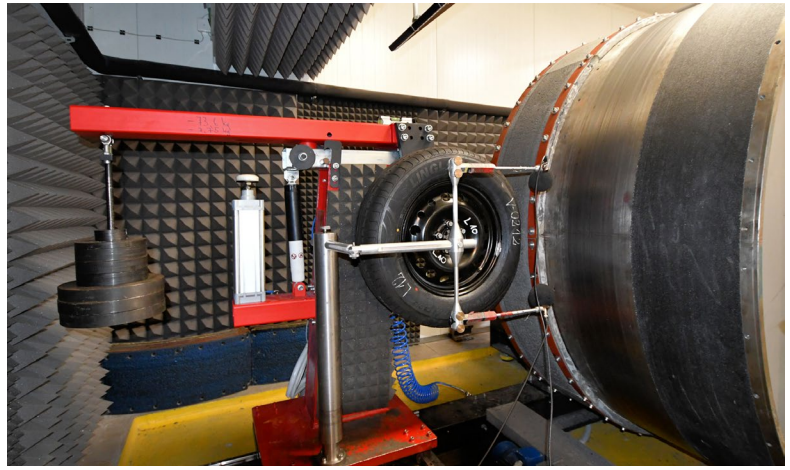
Suggested procedure:

- Periodical (e.g. annual) calibration of the ISO test tracks
- CPB measurements with a vehicle equipped with SRTT tyres
- Determination of overall deviation from virtual ISO test track
- Application of corrections for all measurements done on this test track
- Uncertainty contribution will be reduced from 0,91 – 1,3 dB down to **0,55 dB**

Reducing the uncertainty contribution from the test tyres

Suggested measures:

- Measuring all tyre types on test track = unrealistic
- Recommendation: additional "quick" measurements on drum for all tyre family members
- Uncertainty contribution would go down from 0,64 – 1,18 dB to **0,26 dB**



And further…

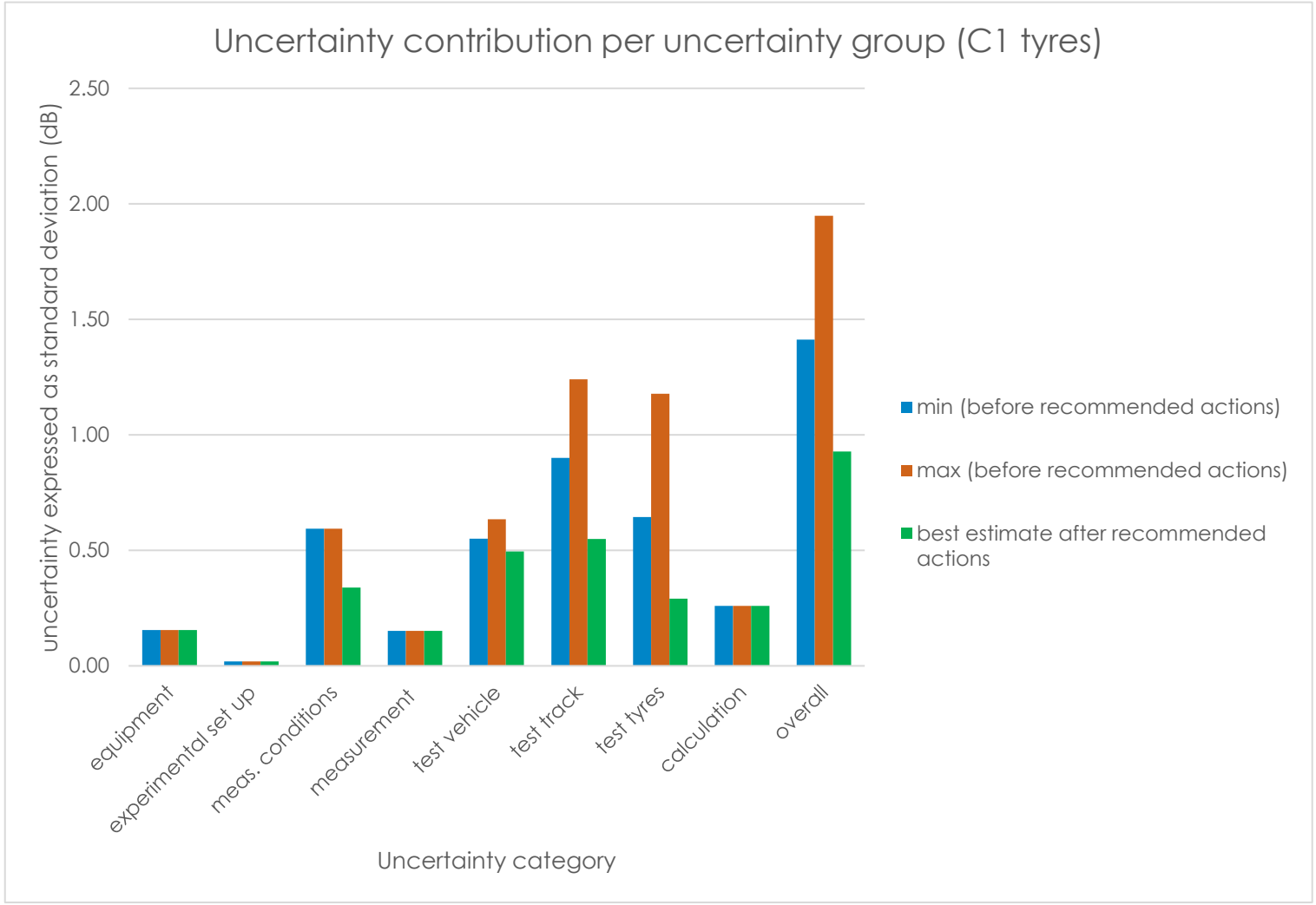
Measurement conditions:

- Updating temperature correction to the state of the art: uncertainty contribution would go down from 0,64 – 1,18 dB to **0,26 dB**

Test vehicle:

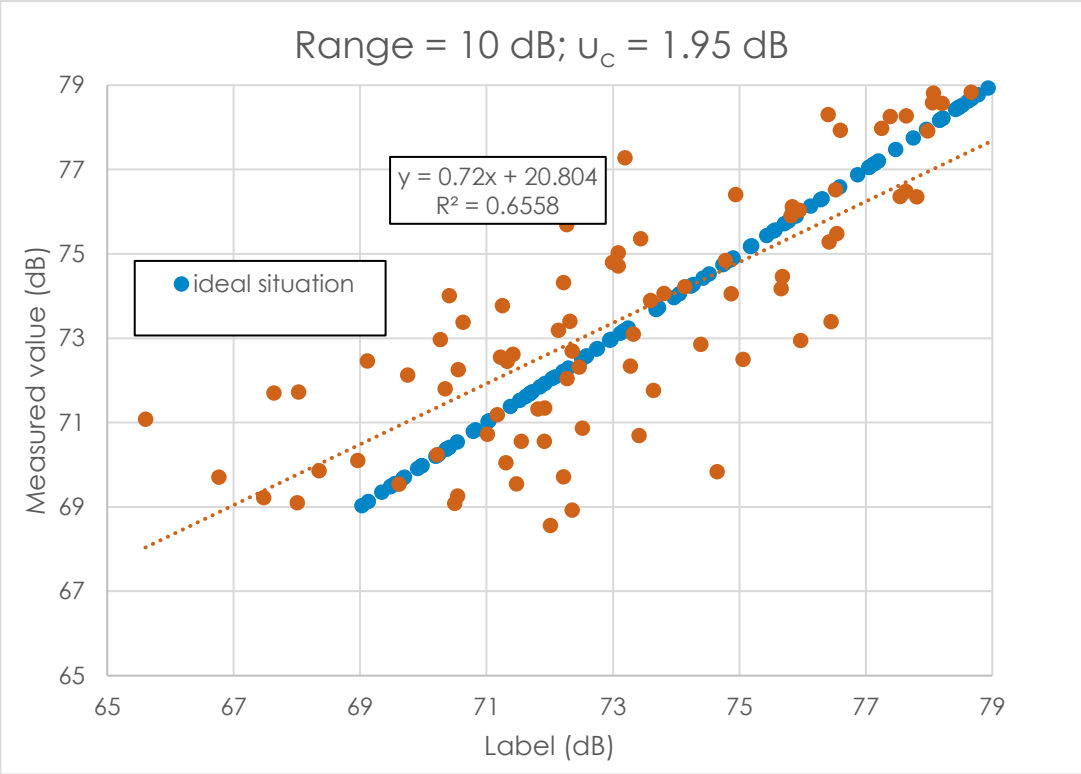
- Narrower specifications for the test vehicle would reduce contribution from 0,55 dB – 0,63 dB to **0,50 dB**

Uncertainty analysis: projected results after STEER recommendations

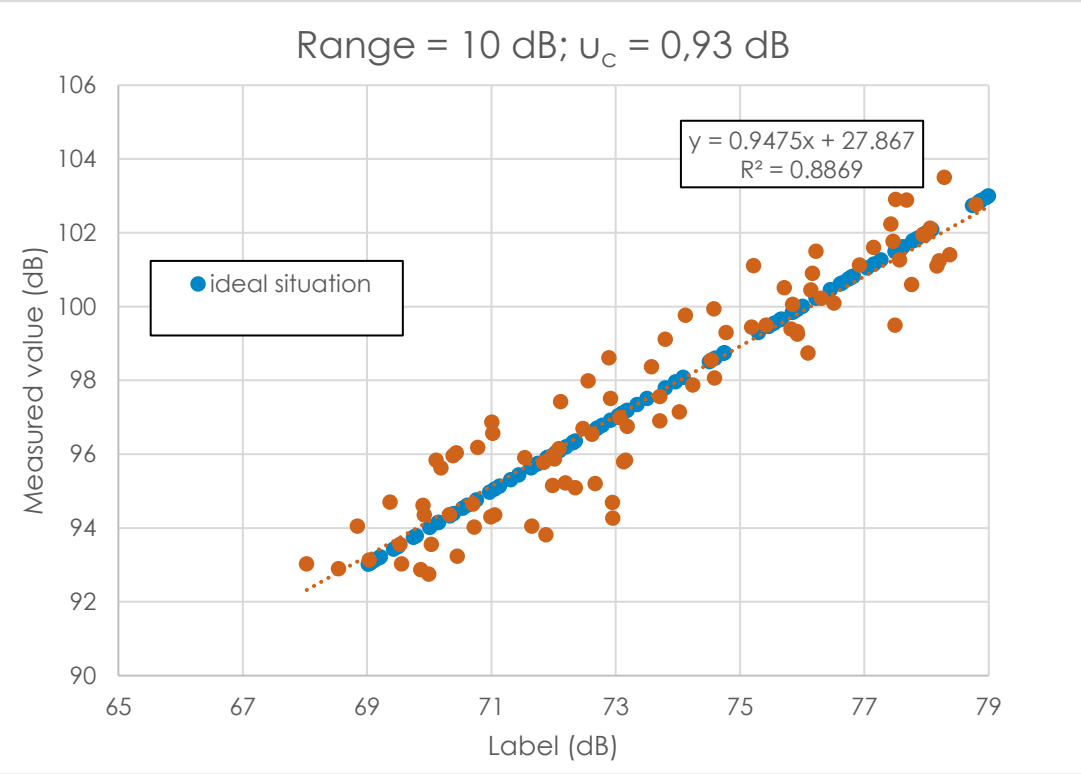


Simulated effect on correlations (10 dB span)

Before recommended measures



After recommended measures



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Thank you!

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