F35 **A Metrologically Sound Assessment of Blood Alcohol Concentration (BAC) Through a Breath Alcohol Concentration (BrAC) Measurement**

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Learning Overview: After attending this presentation, attendees will have a better understanding of the different sources of uncertainty that affect BAC measurements when performed through a BrAC measurement, especially when the major source of inaccuracy does not come from the employed instrument but is implied in the way BrAC is reported to BAC.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by presenting a metrologically sound approach to BAC measurement and by understanding its uncertainty when it is obtained through a roadside BrAC measurement. The multiplicative coefficient to get BAC from BrAC is discussed and how its foundational validity can be stated will be shown, beginning with the available literature and quantified in terms of definitional uncertainty.

Roadside BrAC tests have become the standard method to assess BAC in drivers and represent the most effective tool to fight against DUI crimes in most developed countries. On the other hand, the validity of the obtained measurement results is often challenged and the employed BrAC instruments are considered the major cause of inaccuracy.[1,2]

However, from a strict metrological perspective, this contribution to measurement uncertainty only represents the instrumental uncertainty contribution and yields a quantification of the *validity as applied*, as defined by the President's Council of Advisors on Science and Technology (PCAST) report.[3,4]

Another important contribution to uncertainty, the definitional uncertainty contribution, that quantifies the *foundational validity*, as defined by the PCAST report, has not been considered nor quantified. As a matter of fact, the choice of the proportionality factor to convert the measured BrAC into a BAC, is critical and represents the major source of uncertainty of this method.[3,4]

This presentation seeks to show how this contribution can be quantified, beginning with the data available in the scientific literature combined with the instrumental uncertainty to evaluate the overall uncertainty in the determination of a BAC starting from a BrAC measurement.[5,6]

This presentation will be also show how, starting from the obtained uncertainty value, it is possible to evaluate the probability that a BAC value higher than a given threshold may actually be lower than the threshold, thus quantifying the doubt of not making a right and fair decision.

Reference(s):
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3. President's Council of Advisors on Science and Technology (PCAST). *Report to the President: Forensic Science in Criminal Courts: Ensuring Scientific Validity Of Feature-Comparison Methods.* (2016). Washington, DC: Executive Office of the President of the United States.
4. Ferrero, Alessandro and Scotti, Veronica. An Interpretation of the 2016 PCAST Document in Terms of Forensic Metrology. *Proceedings of the American Academy of Forensic Sciences*, 70th Annual Scientific Meeting, Seattle, WA. 2018. 581.
5. Jones, Alan W., Andersson, Lars. Variability of the Blood/Breath Alcohol Ratio in Drinking Drivers. *Journal of Forensic Science*, 41, n6 (1996), 916-921.
6. Jones, Alan W., Andersson, Lars. Comparison of Ethanol Concentrations in Venous Blood and End-Expired Breath During a Controlled Drinking Study. *Forensic Science International*, 132 (2003). 18-25.

BrAC, BAC, Uncertainty