# Non-invasive Raman-based Glucose Monitoring with weeks of sustained calibration
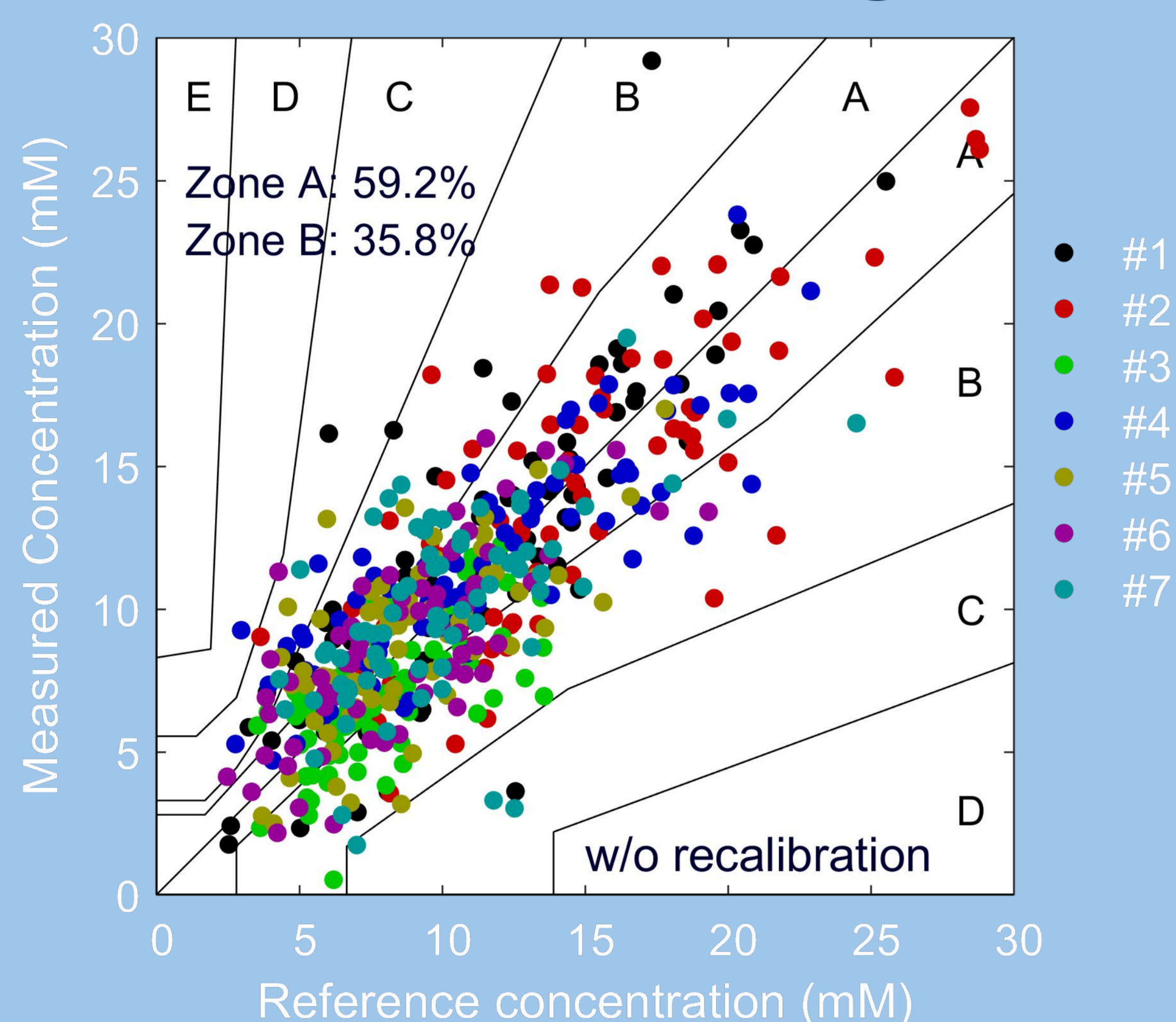
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**Objective:** Stability of calibration is an important quality of non-invasive and continuous glucose monitoring devices. Herein, we assess the sustainability of calibration models of non-invasive Raman-based glucose monitors by comparing the predictive performance without and with weekly recalibrations.
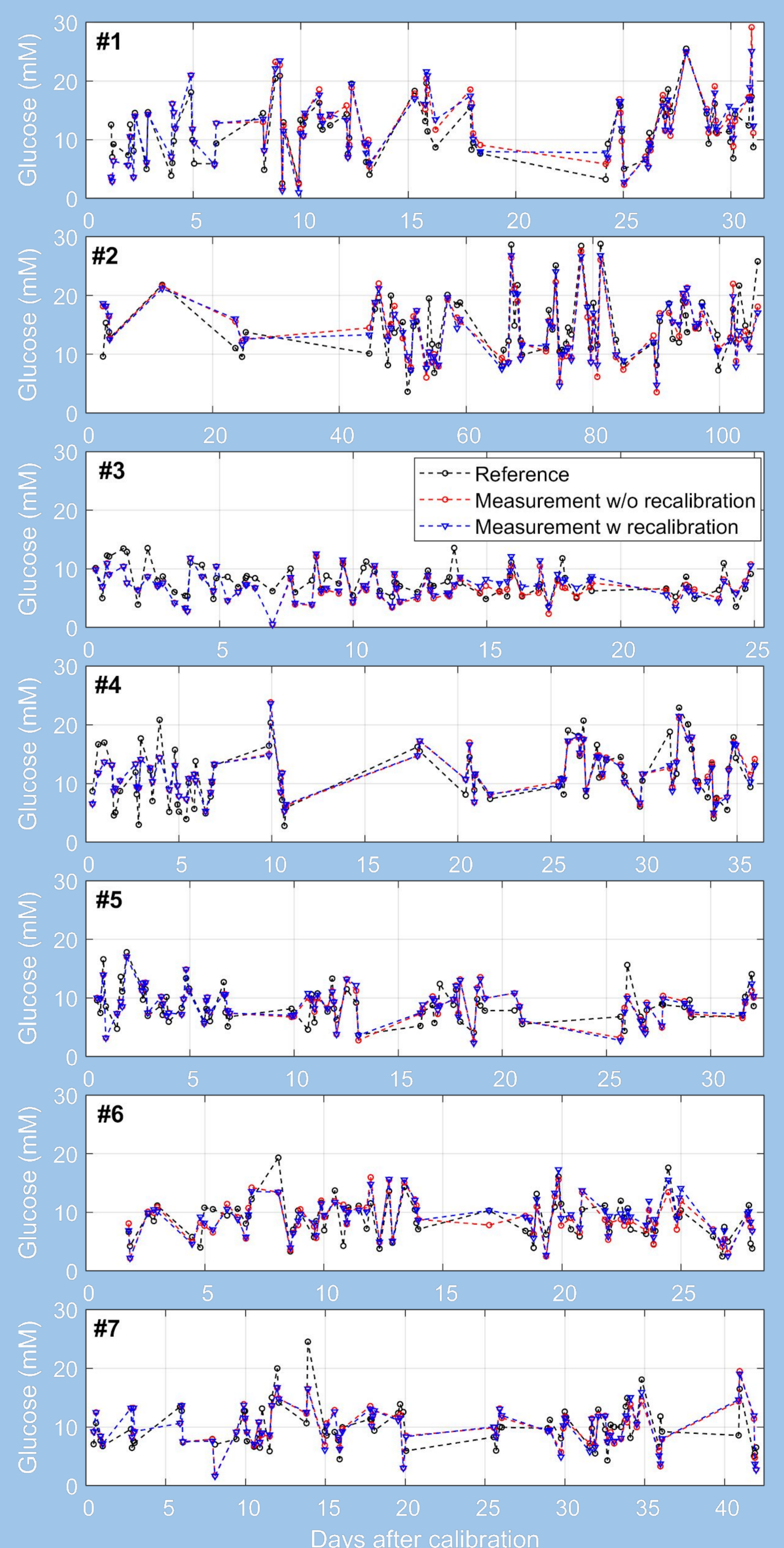
**Method:** Raman spectra are recorded from the thenar of diabetic subjects using RSP Systems' working model WM3.4 with accompanying glucose references obtained using Hemocue 201. Data comprises 7 subjects from the outpatient protocols RSP-07/10. PLS regression models are sought robust towards non-glucose spectral variations by including 40 days of analysis, where each day contains 4 paired measurements. The validation period is subject-dependent and varies between 25 and 106 days. In the scenario with recalibration, two additional reference measurements are added to the model every seventh day.

**Results:** The scenario without/with recalibration shows an average Inter-Subject Unified Performance[1] (ISUP) of 2.63/2.71 and Mean Average Relative Deviation (MARD) of 24.9%/25.0%.

## Consensus error grid



## Measurements vs time



## Performance metrics

| Subject # | RMSEP (mM) | MARD (%) | $R^2$ | ISUP |
|---|---|---|---|---|
| 1 | 3.21/3.84 | 26.0/27.5 | 0.68/0.69 | 3.95/3.84 |
| 2 | 3.55/3.39 | 23.3/21.4 | 0.60/0.62 | 2.52/2.69 |
| 3 | 2.29/2.30 | 23.7/24.7 | 0.41/0.37 | 2.38/2.02 |
| 4 | 2.58/2.53 | 24.4/24.3 | 0.74/0.75 | 3.03/3.08 |
| 5 | 2.39/2.39 | 24.7/24.4 | 0.43/0.43 | 2.36/2.40 |
| 6 | 2.46/2.32 | 27.8/27.7 | 0.52/0.58 | 2.65/3.17 |
| 7 | 3.03/2.95 | 25.2/25.1 | 0.38/0.41 | 1.52/1.76 |
| **Avg.** | 2.78/2.73 | 24.9/25.0 | 0.54/0.55 | 2.63/2.71 |

Overall performance metrics of seven subjects without/with weekly recalibration

**Conclusion:** The insignificant effect of weekly recalibrations indicates that Raman-based glucometers can sustain calibration for weeks

[1]S. M. Lundsgaard-Nielsen *et al*. (2018). PLoS ONE 13(5): e0197134

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