EEC TEAM DATA ANALYSIS

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PMP TF3

EEC FILES: INTRODUCTION

17	Labs announced participation
16	Labs delivered data
1	Lab (Lab B) has withdrawn its data from emission evaluation
75	EEC Files delivered
160	MByte of Data
203000	Data lines analysed

- EEC Files: brake Event-based files
  - are derived from time-based EED files
  - Contain data from bedding and emission cycles
  - Should contain 303 data lines per cycle
  - 1 data line = data for one of the 303 brake events

- Software Tools used
  - R: for data agglomeration and analysis
  - Tableau: for visualization

EEC TEAM: FIRST STEPS & FINDINGS

First EEC-Files with Version 0

- Main Issues:

  - Header lines different to example file

  - Header sections missing

  - Leading blank lines deleted / structure changed

  - Naming of Excel tabs no unique
    "Bedd. 1" vs. "Bed.1" etc

  - Data strategy for missing data or not connected sensors
    different for different labs
    => Air temp or air speed = -40 °C

  - Big variance in data strategy for Columns A...C
    "Sect #", "Stop #", "brake_data_begin Stop"

  - Missing bedding or emissions measurements

- New file versions V1, V2... created in close exchange with labs and Theo, mostly done by Theo

EEC FILES: DATA DELIVERED
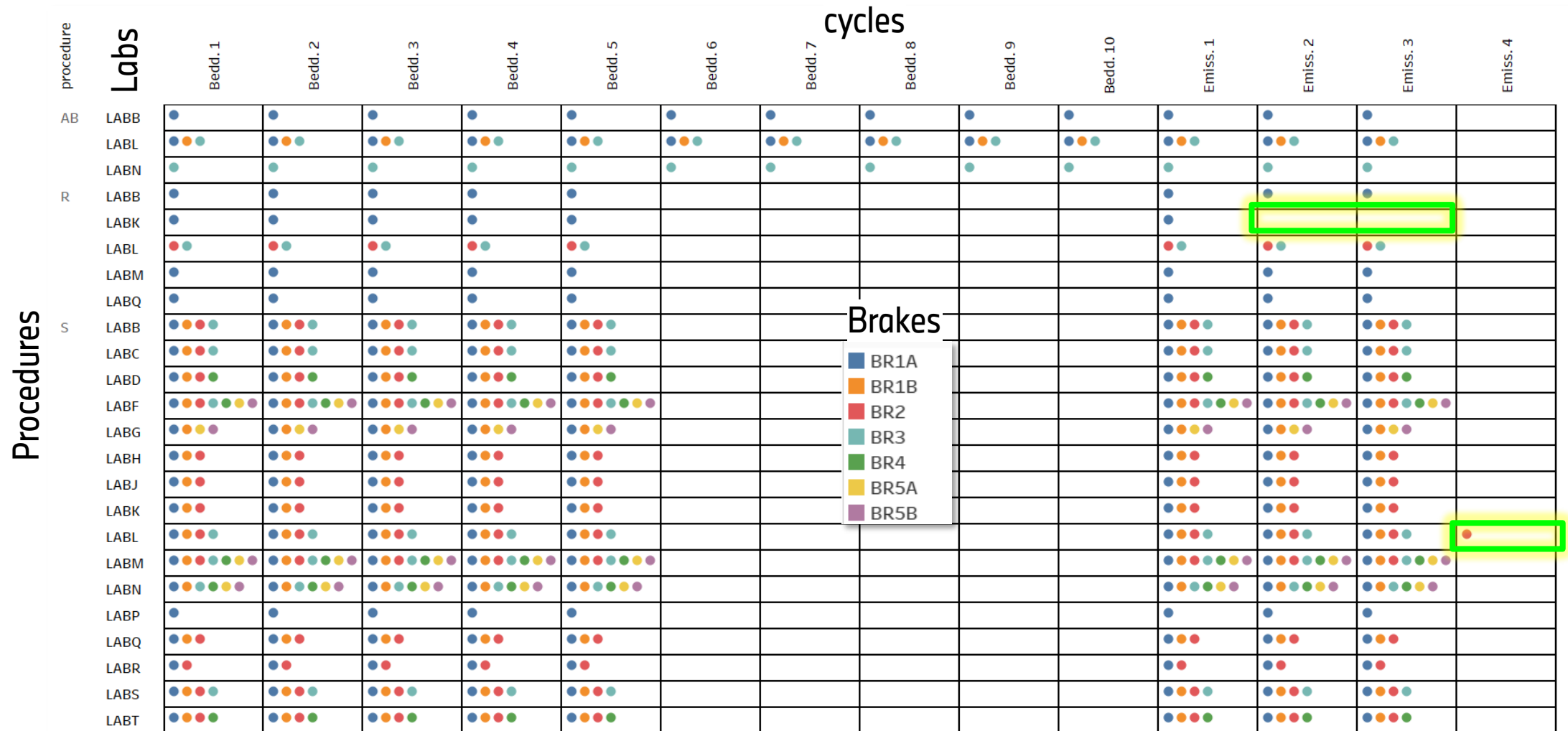
- 75 EEC Files received
- Equal amount of files from all labs had to be revised:
  - cooling sections removed to create the revised versions (V1 / V2… V5).
  - Additionally, negative and zero values were removed and substituted by empty cells not to compromise the statistical analysis.

EEC FILES: AIR TEMPERATURES PER LAB
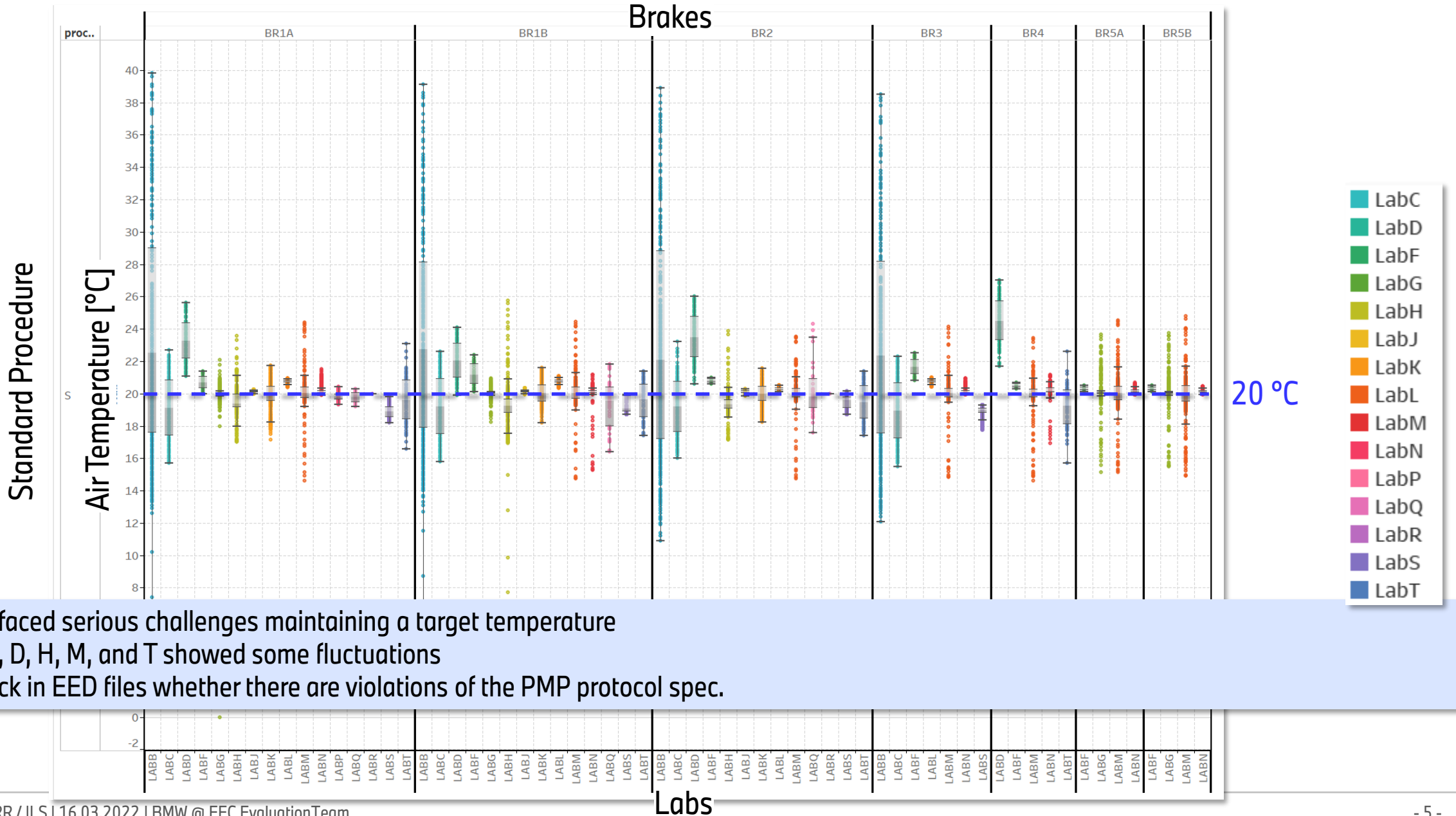
- Lab-B faced serious challenges maintaining a target temperature
- Labs C, D, H, M, and T showed some fluctuations
  ➔ check in EED files whether there are violations of the PMP protocol spec.

EEC FILES: AIR HUMIDITY
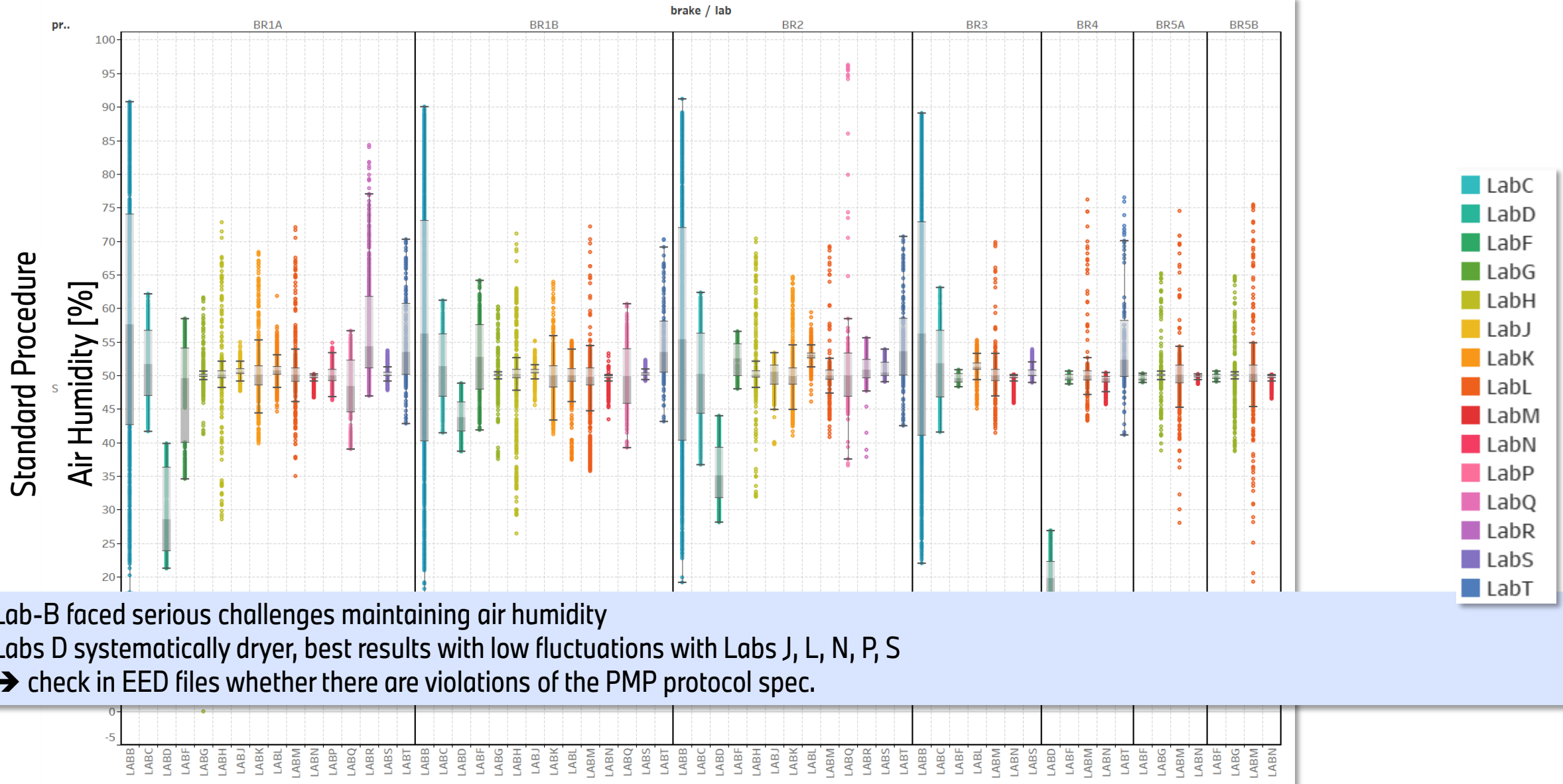
- Lab-B faced serious challenges maintaining air humidity
- Labs D systematically dryer, best results with low fluctuations with Labs J, L, N, P, S
  ➔ check in EED files whether there are violations of the PMP protocol spec.

EEC FILES: CORRELATION OF BRAKE SPEED PROFILE VS. SETPOINT (1)

- Systematic error for Lab D
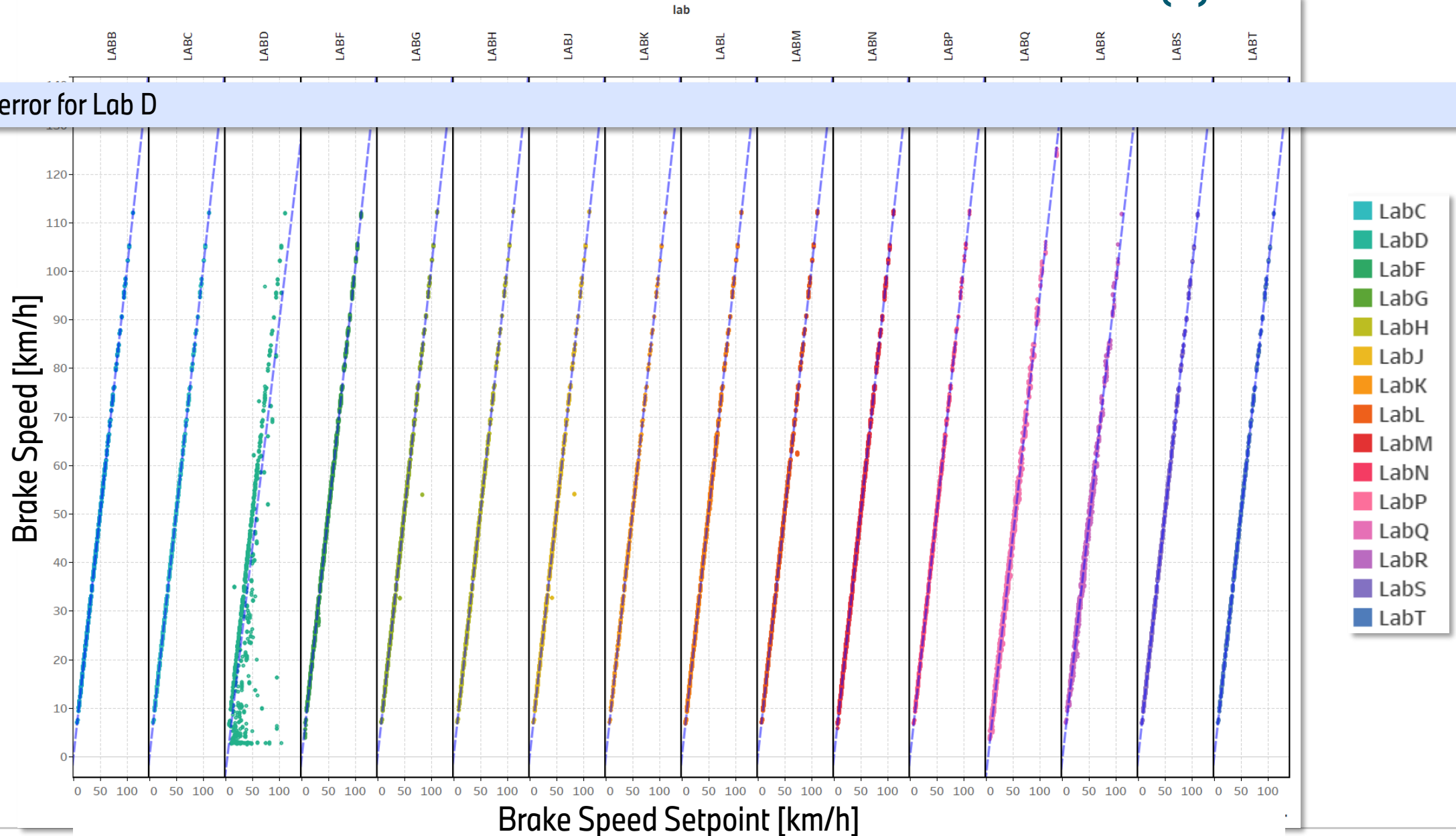
EEC FILES: CORRELATION OF BRAKE SPEED PROFILE VS. SETPOINT (2)

Standard Procedure

Δ (Brake Speed vs. Brake Speed Setpoint) [km/h]

Only data for emissions tests shown,
without bedding steps

- Systematic error for Lab D
- Good controls for Labs B, C, F, H, L, N, P, S, T
- Outliers for Lab G, J and M
- Deviations for Lab Q & R

Legend:
- LabC
- LabD
- LabF
- LabG
- LabH
- LabJ
- LabK
- LabL
- LabM
- LabN
- LabP
- LabQ
- LabR
- LabS
- LabT

Labs: LABB, LABC, LABD, LABF, LABG, LABH, LABJ, LABK, LABL, LABM, LABN, LABP, LABQ, LABR, LABS, LABT
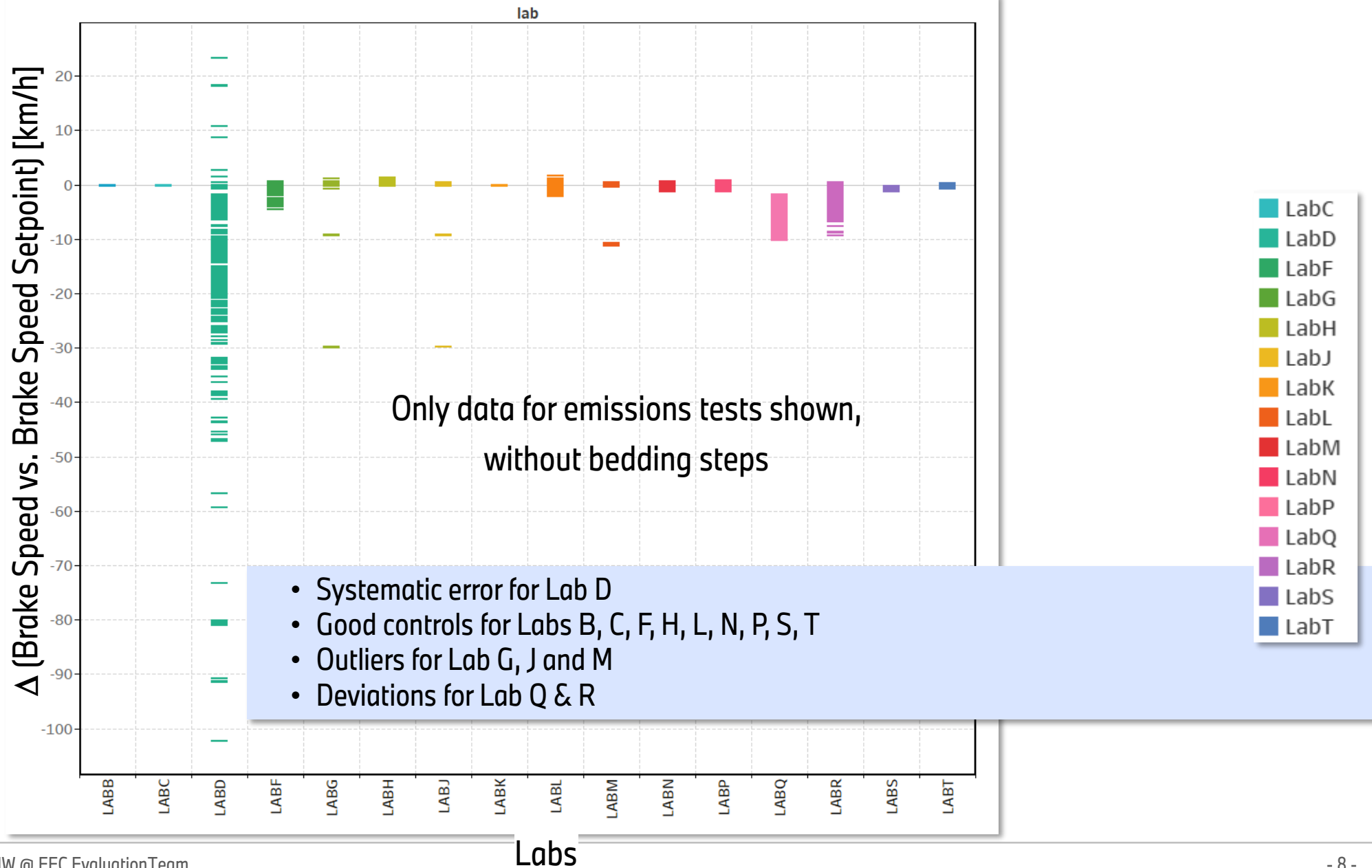
- Perfect brake speed control would result in an ideal bisectrix in the plot (fitting line slope = 1, intercept = 0)
- Systematic error for Lab D
- Good controls for Labs B, C, F, H, L, N, P, S, T
- Deviations for Lab Q & R ➜ see also fitting curve parameters

lab	slope	Std-Error	intercept	Std-Error
LABK	1,00014	8,10E-05	-0,001845	0,004033
LABR	0,97488	0,002339	-0,908465	0,115455
LABQ	0,97777	0,001163	-3,64419	0,055265
LABD	0,92074	0,020314	-3,26382	0,94604
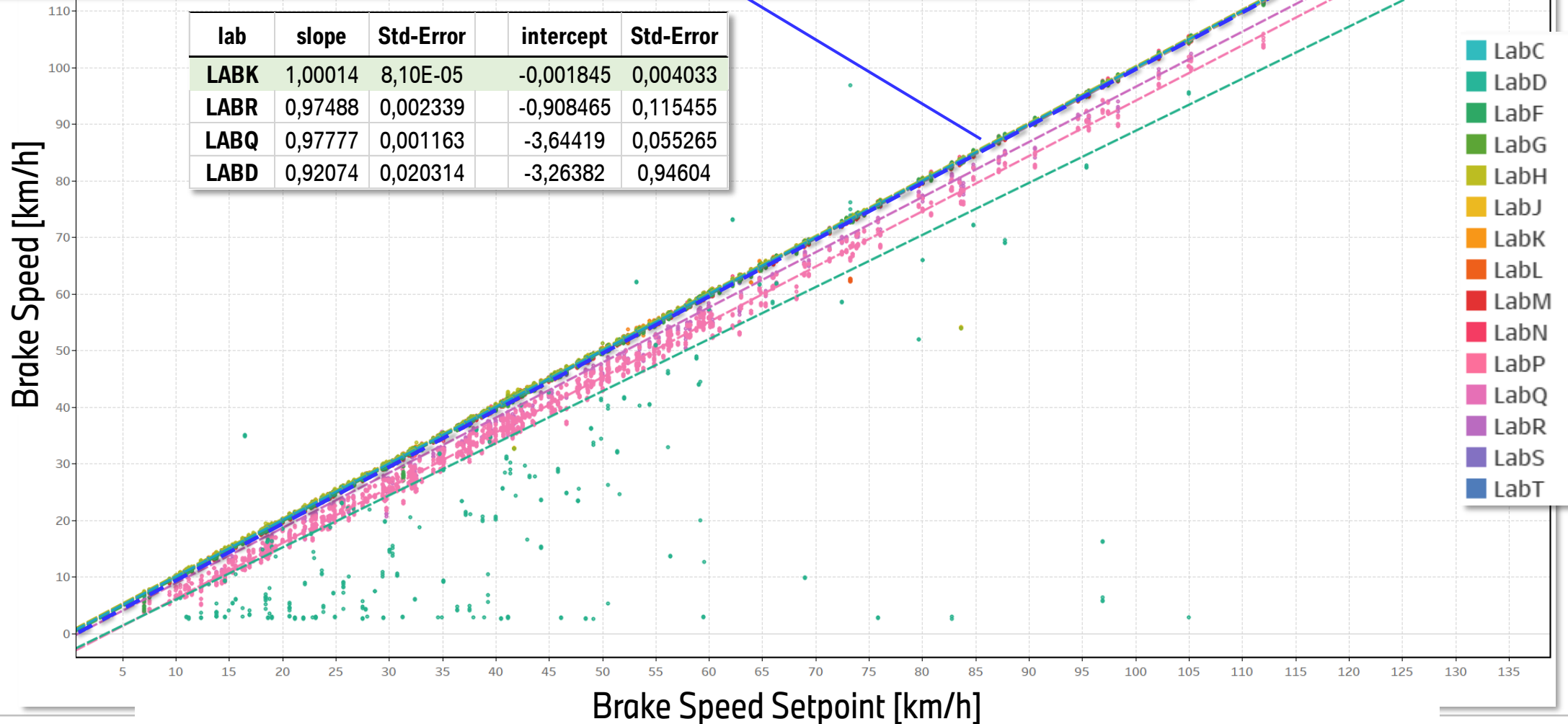
EEC FILES: AIR SPEED

- Deviations for Lab B
- High variations for Lab G & Q
- Bigger variations for Lab L

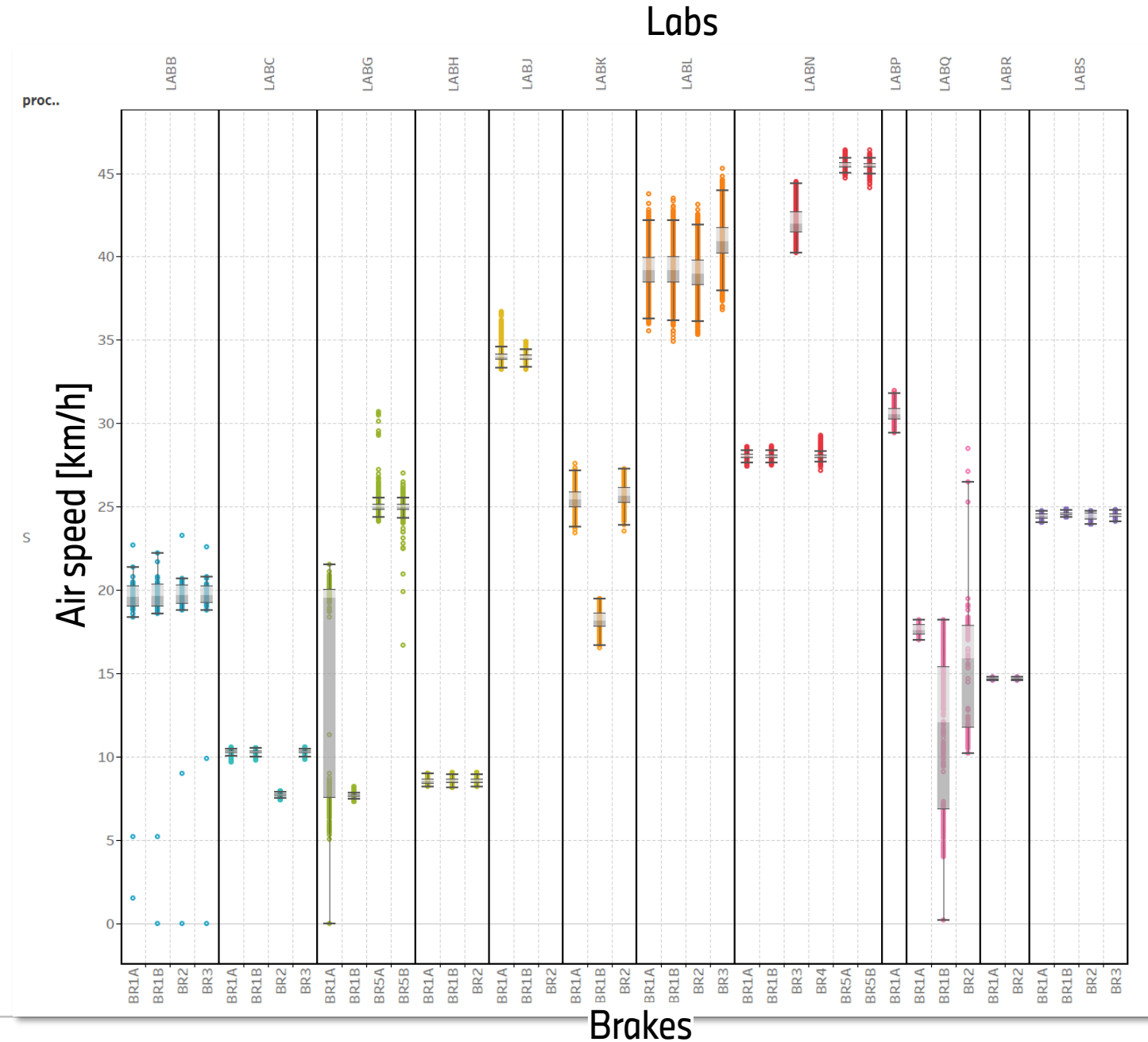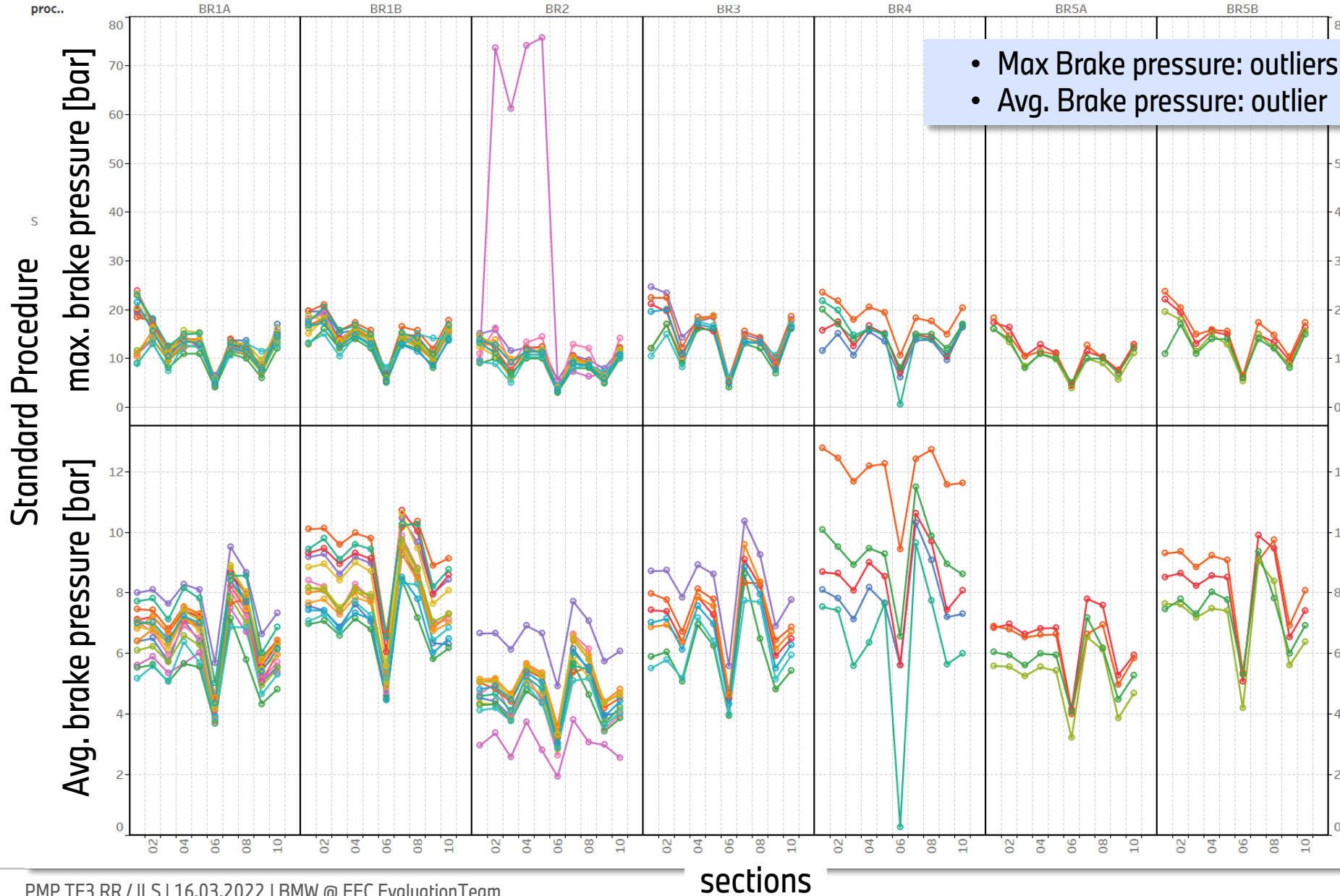# EEC FILES: BRAKE PRESSURES

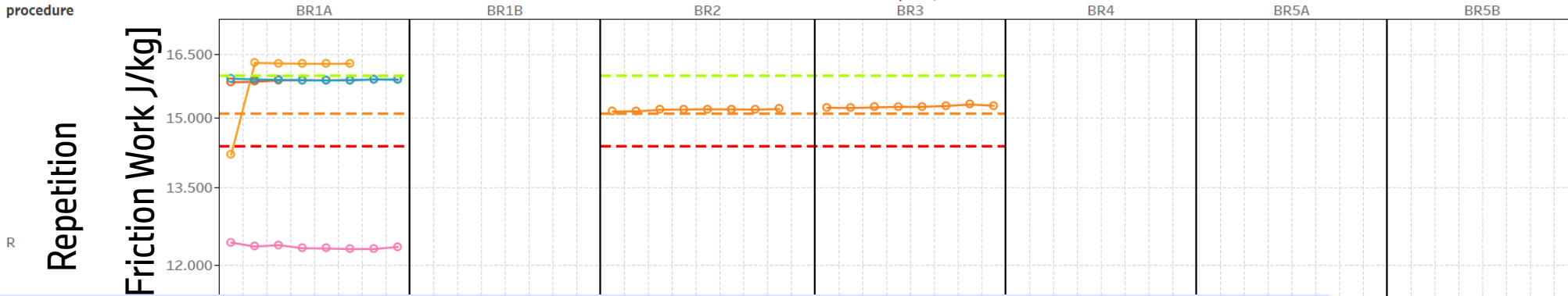- Max Brake pressure: outliers for Lab R, Brake 2
- Avg. Brake pressure: outlier for Lab D, Brake 4

EEC FILES: FRICTION WORK

- Some labs above theoretical value of 15.983 J/kg: Labs G, J, K, (M), N, R, S
- Some labs in 5 % range deviation: Labs B, D, (H), L, M, (S), T
- Some labs n 10 % range deviation: Lab C, (D), H, (Q)
- Labs > 10 % of range deviation: Lab (C), F, (G), (H), P, Q, (R), (T)
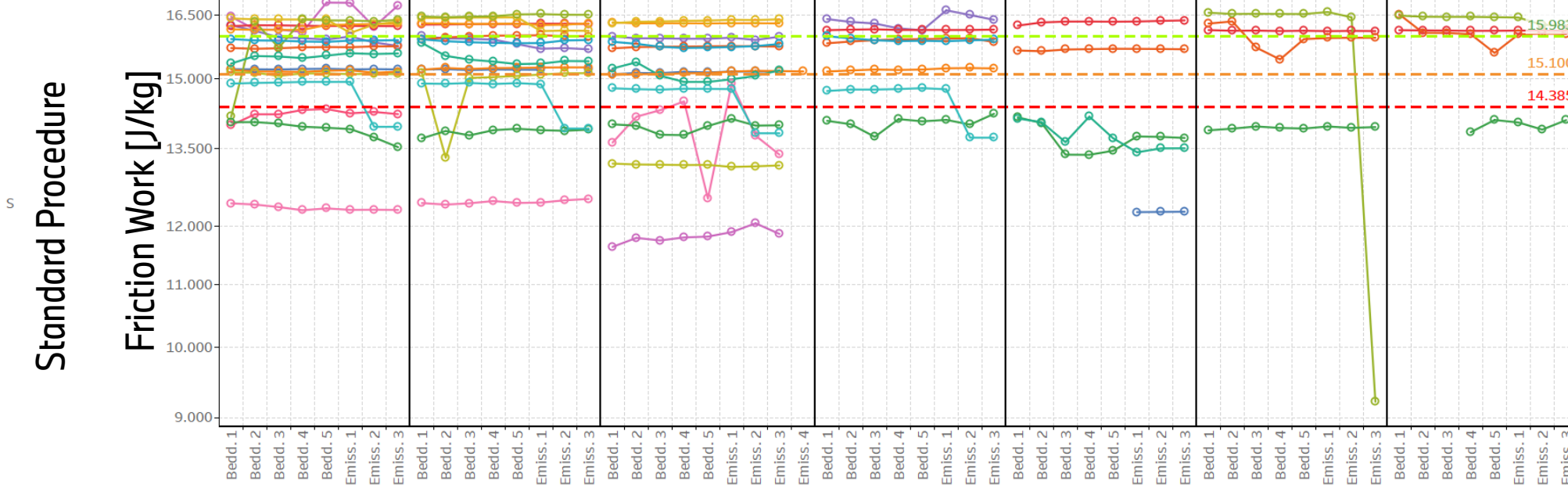
- Some labs below target value of min. temperature
  - For WL/DM 44.6: Lab R,
  - WL/DM 81.5: Lab F & T
  - WL/DM 88.1: Lab D

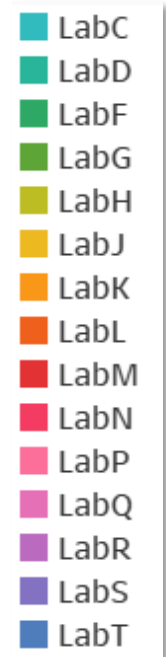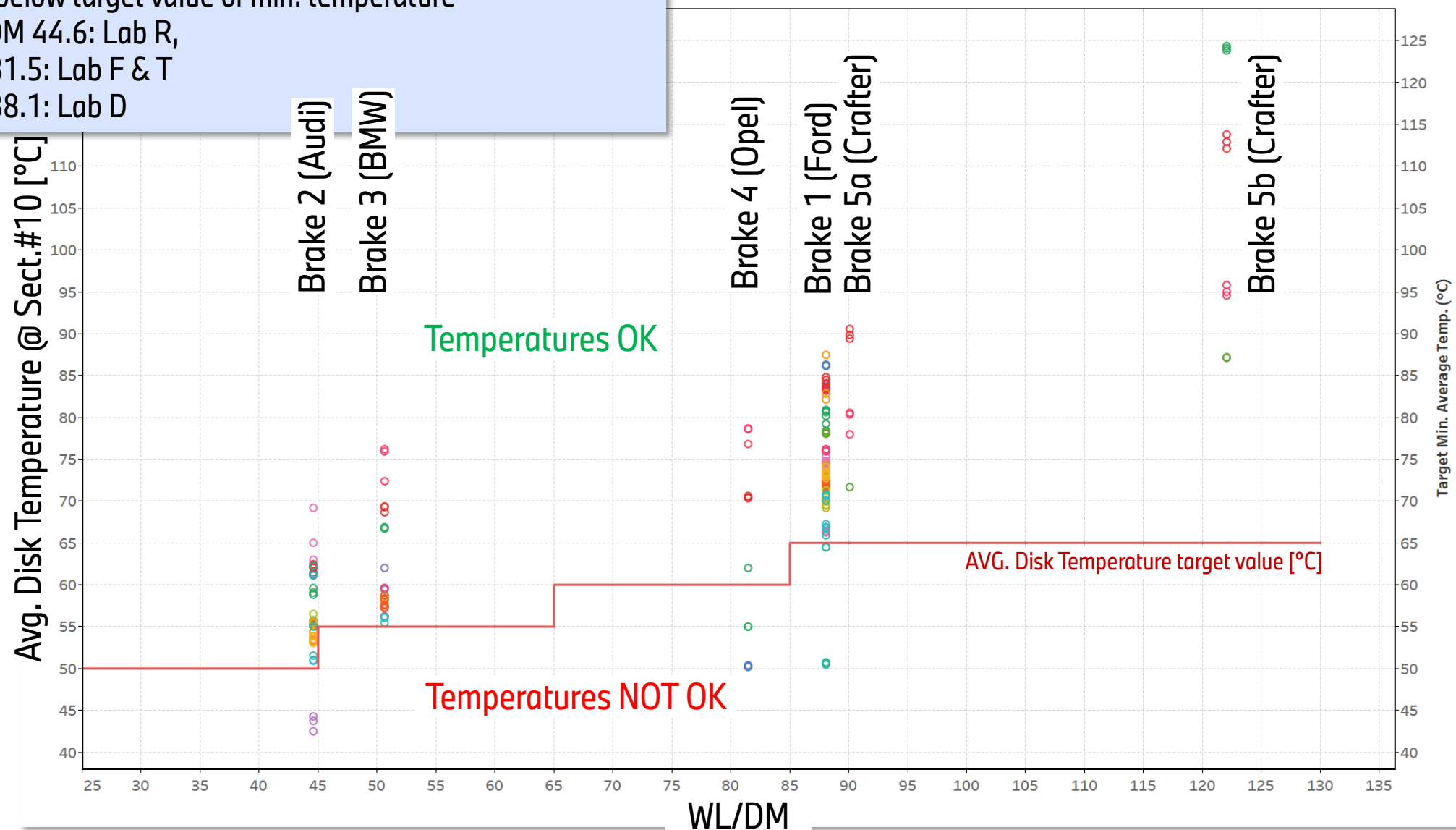# EEC-FILES: DISK TEMPERATURES: FBT

- few labs below target value of min. FBT temperature
  - WL/DM 88.1: Lab R
- several labs above target value of max. FBT temperature
  - WL/DM 81.5: Lab M & N
  - WL/DM 90.1: Lab F & M
  - **WL/DM 122.1: All measurements! Lab F, G, M, N**

WL/DM	Mean [°C]	5% IBT [°C]	5% FBT [°C]
≤45	>50*	55±15*	85±25*
>45 & ≤65	>55	65±15	105±25
>65 & ≤85	>60	75±15	120±25
>85	>65	85±15	140±25

* To be revisited when more data from brakes with WL/DM ratio <45 become available

JRC [PMP-IWG Meeting, Dec 1st 2021, Theo Grigoratos et al.],