



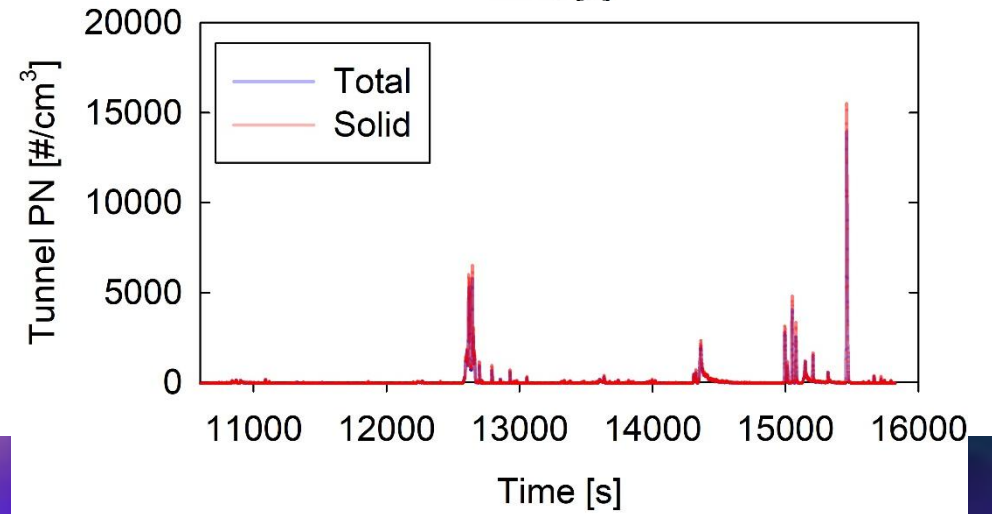
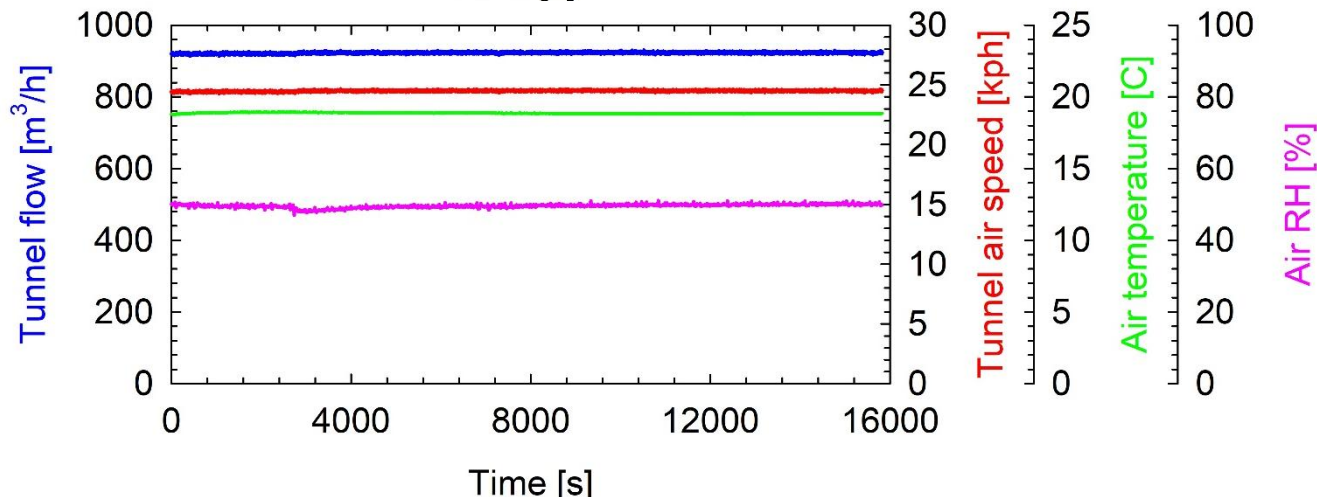
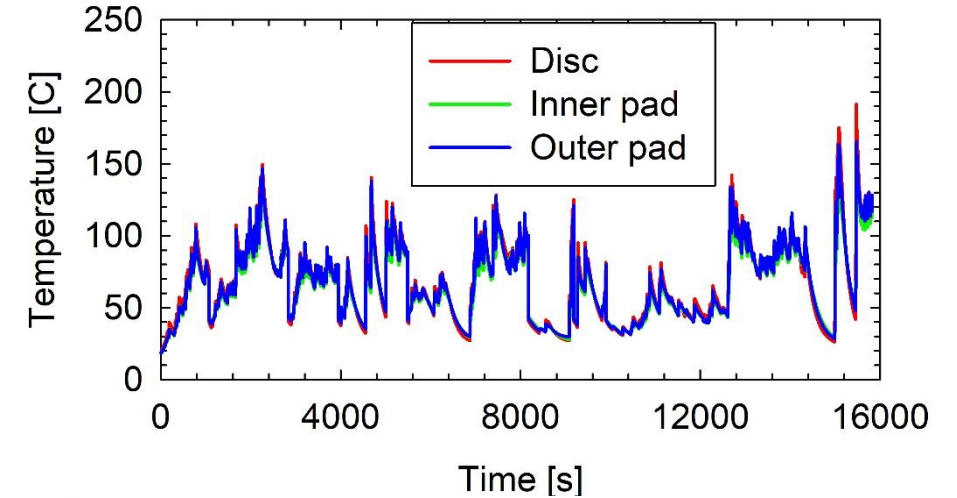
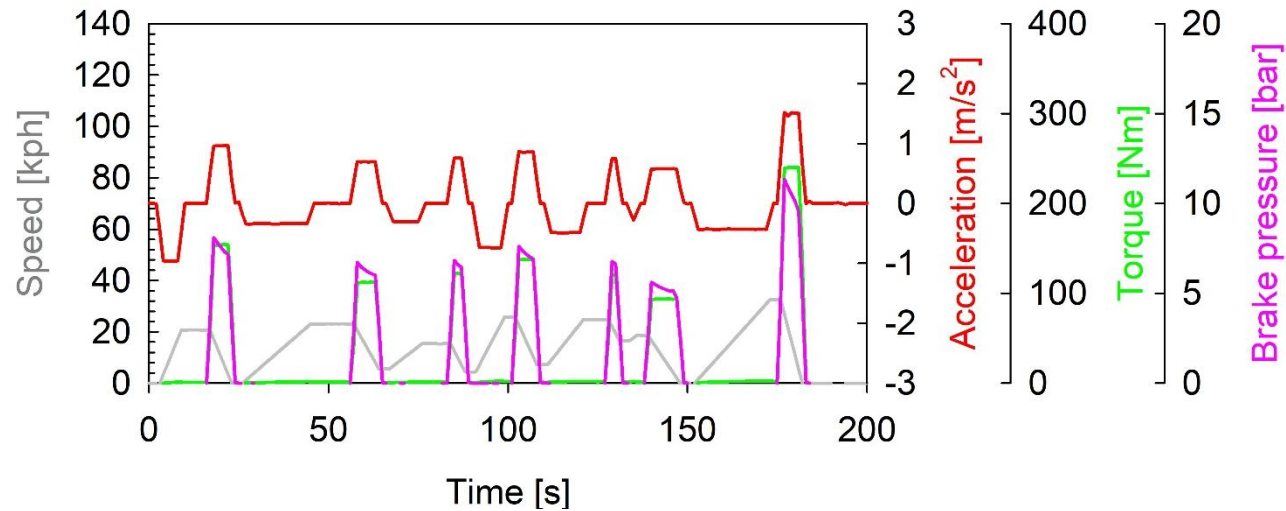
EED files

High Level Analysis

Mamakos, Athanasios

EED files format

- EED files contain 1 Hz of aligned data from essential dyno (speed, brake pressure and torque, acceleration, friction coefficient), tunnel (flowrate, airspeed, temperature, RH, pressure), brake temperature (disc, pads), PN (concentration, PCRF for total and optionally solid), PM samplers (flows)

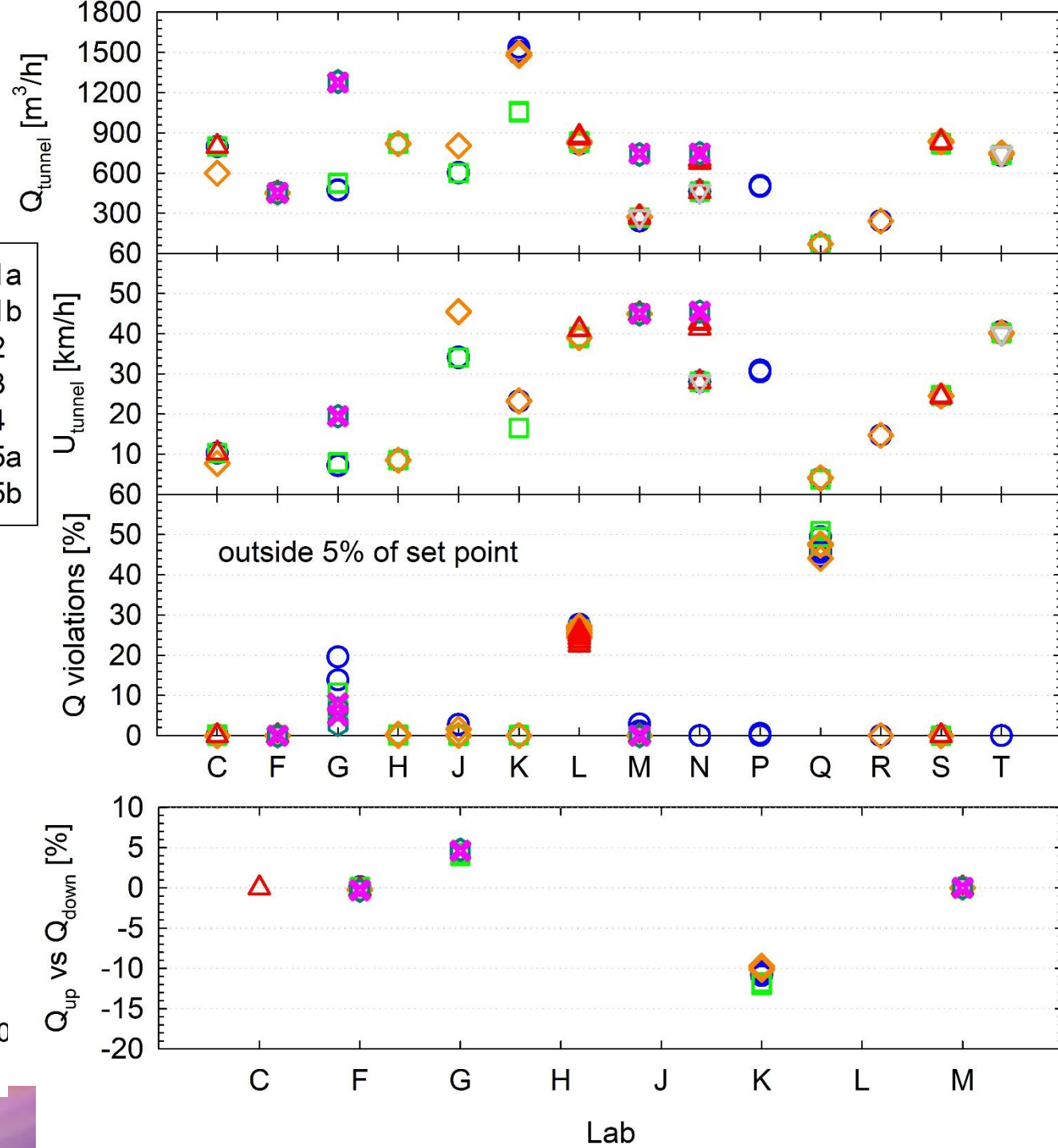
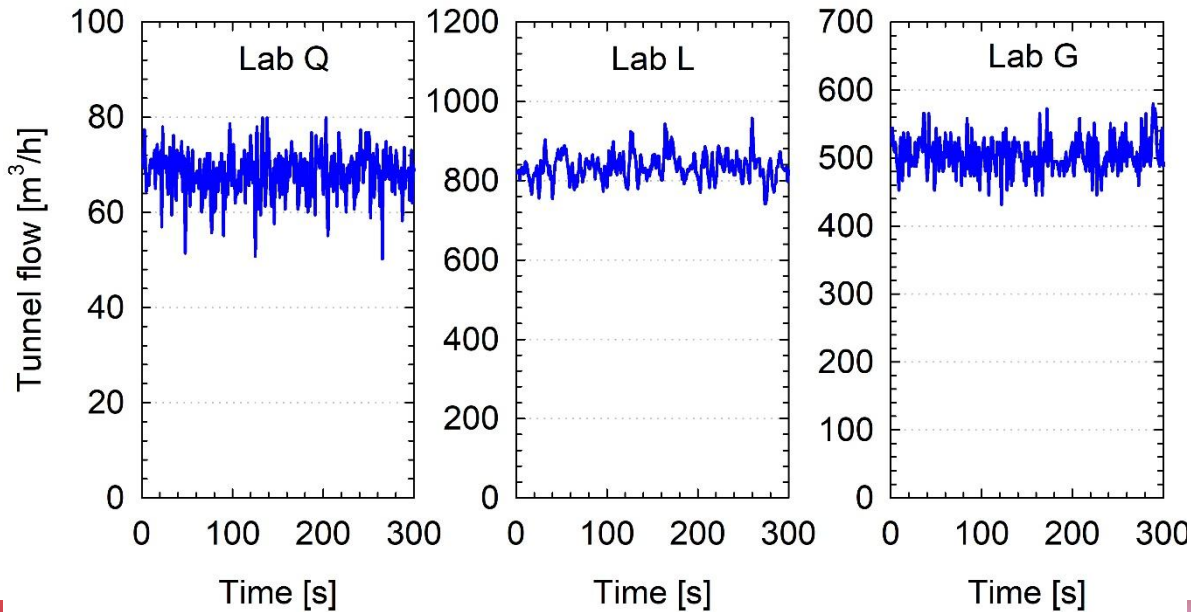
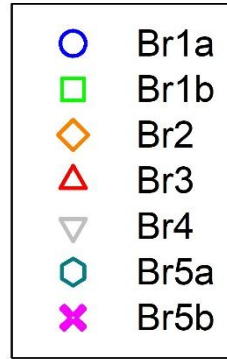


EED files analysis

- EED files have been properly aligned for all labs but B and D. Lab D reported issues with the extraction and that they could not recover the files.
- Parameters extracted from the EED files include:
 - Speed violations
 - Speed RMSE
 - Cooling air humidity violations
 - Cooling air temperature violations
 - Cooling airflow violations
 - Cooling air average temperature
 - Cooling air flow & air speed average
 - Average and maximum disc temperature
- Additionally, cycle-average PN emissions were calculated

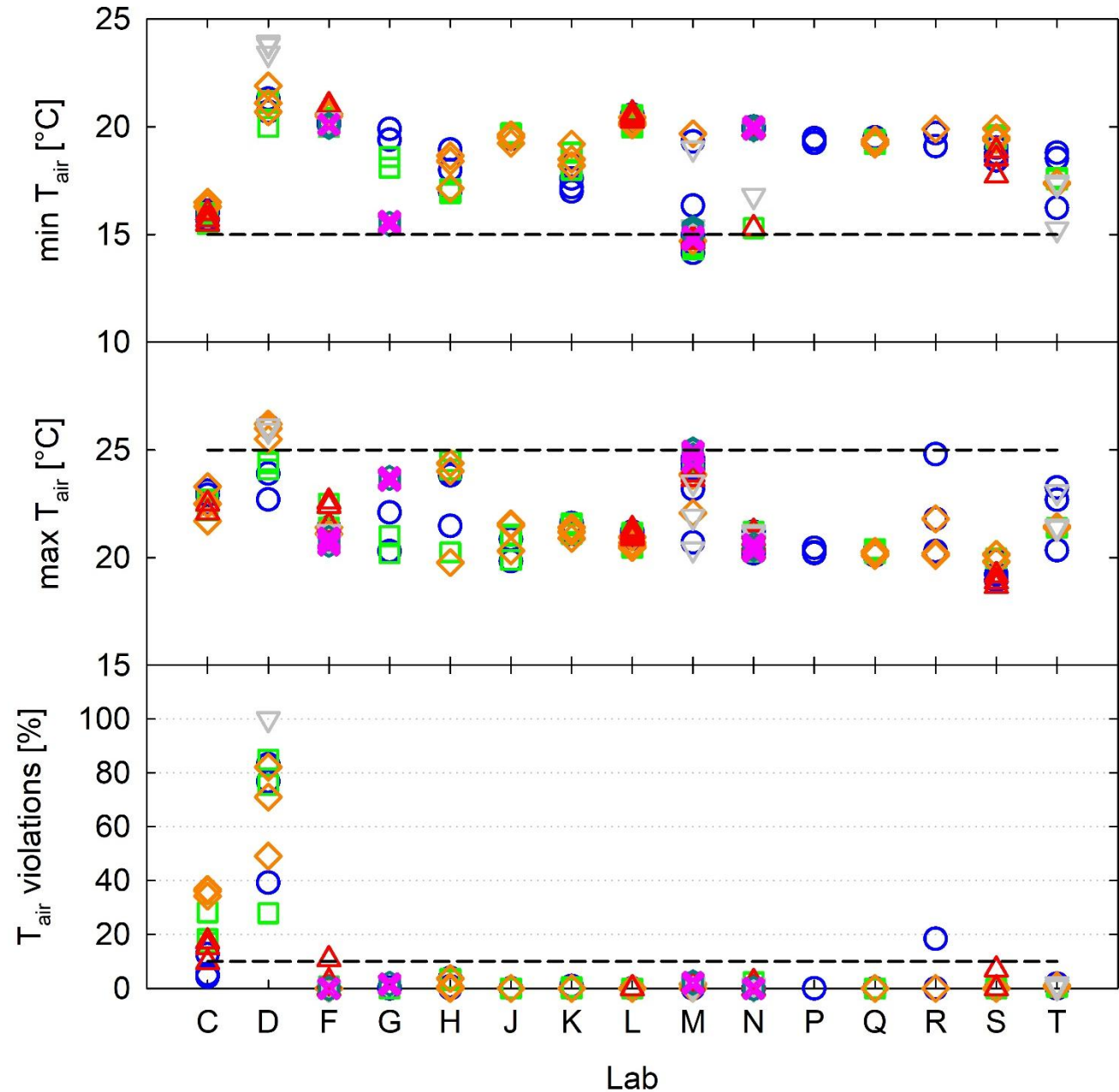
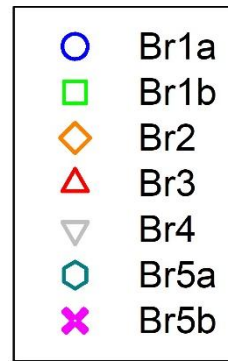
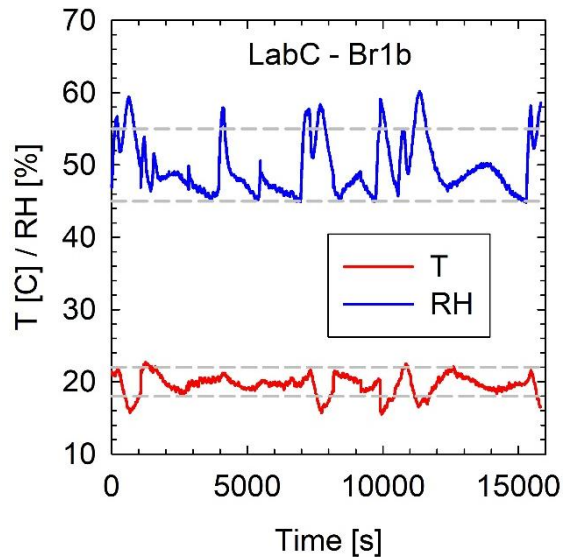
Tunnel flows / speeds

- Instantaneous tunnel flow measurements at Labs G, L and Q varied by more than 5% of set point due to noisy signal.
- Lab G measured 5% higher flow and lab K, 10% lower flow upstream of the enclosure than downstream → leak check & flow accuracy requirements.



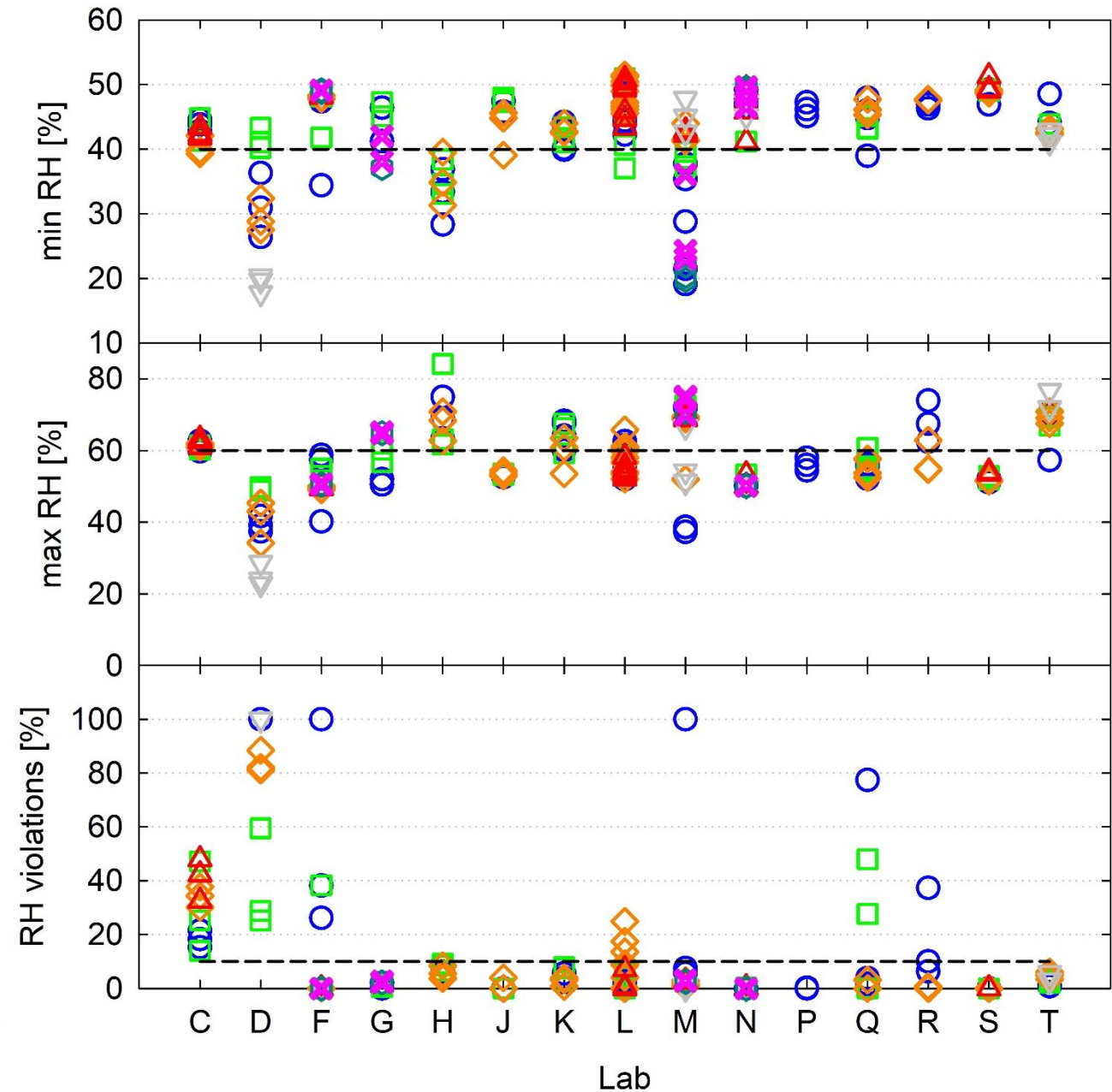
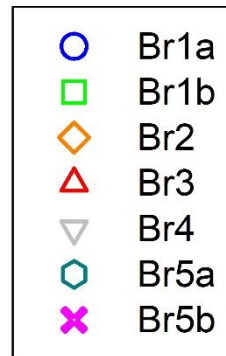
Cooling air temperature

- Labs C & D had issues controlling the cooling air temperature.
- Issues in specific tests of some labs:
 - Lab F for 1 Br3
 - Lab R for 1 Br1a
- Lab M had temporarily temperatures slightly outside the $\pm 5^\circ\text{C}$ in some tests.



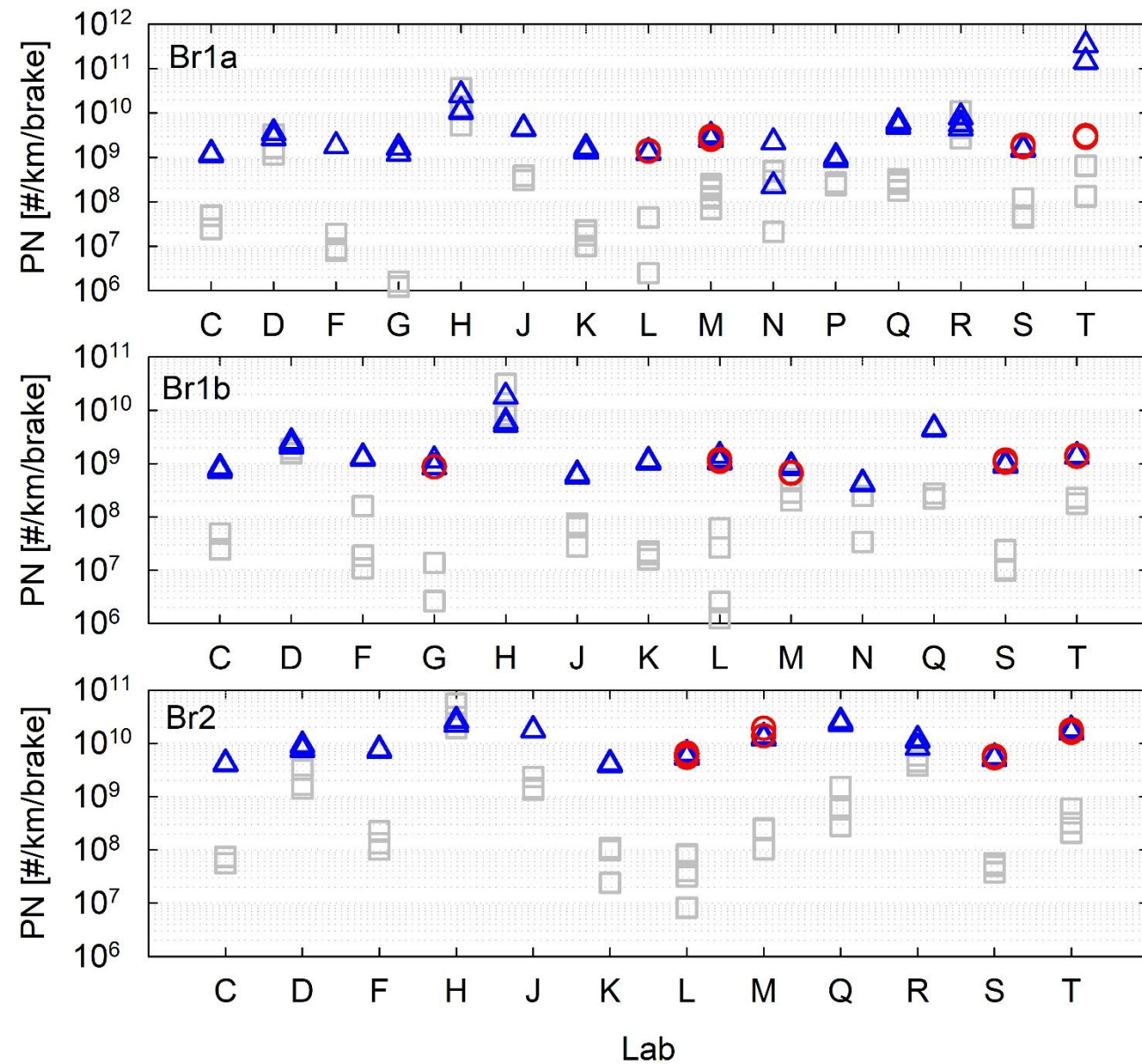
Cooling air humidity

- The cooling air relative humidity was much more difficult to control.
 - All exhaust regulations specify absolute humidity for this reason.



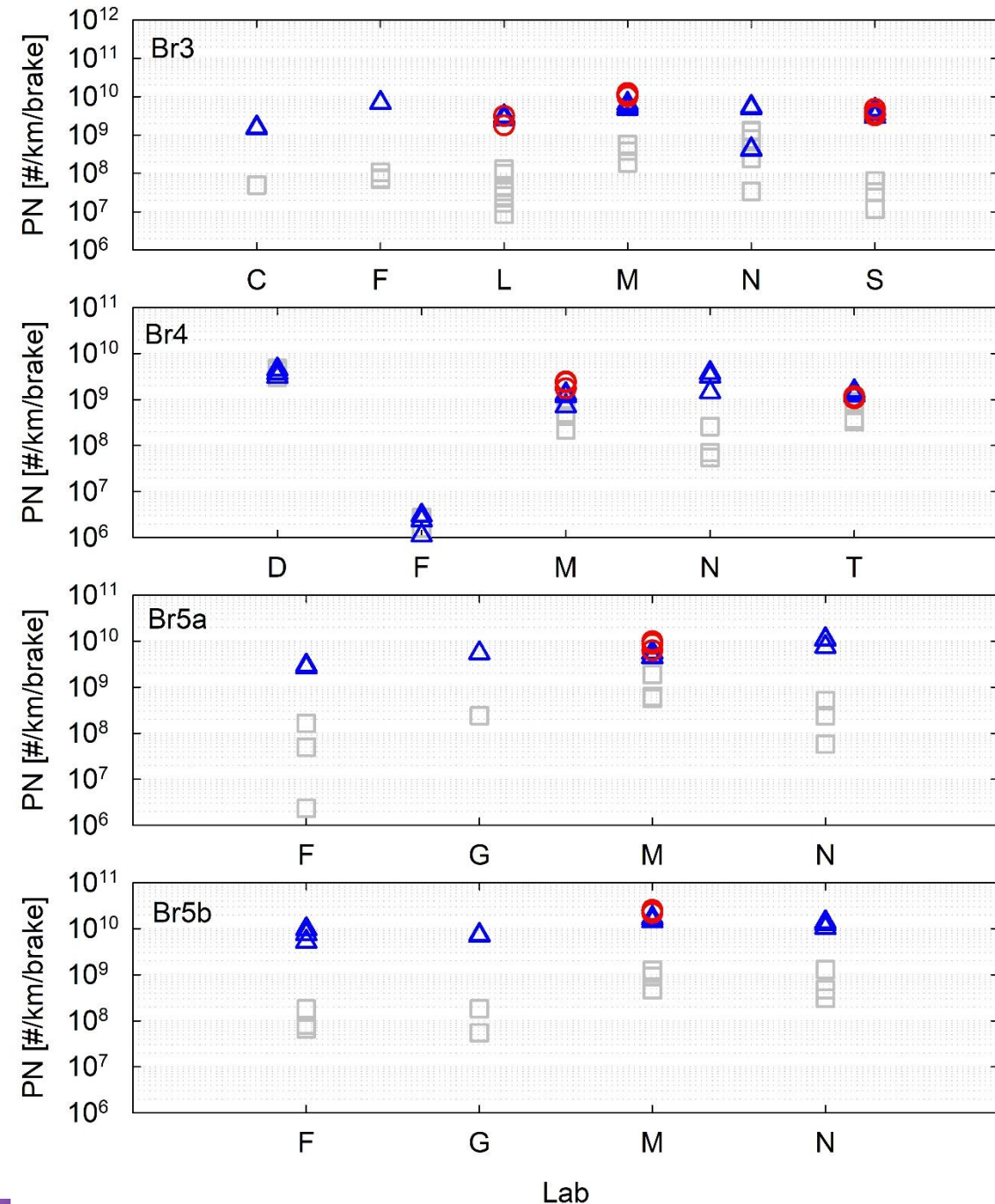
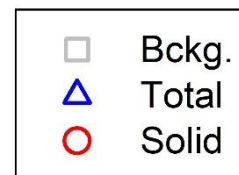
PN emission rates mandatory brakes

- Labs D, H & R had background levels similar to measured emission levels → PN results from these specific labs are unreliable.



PN emission rates additional brakes

- PN emissions from Lab F for Br4 are unrealistically low → below their reported background in other brakes.

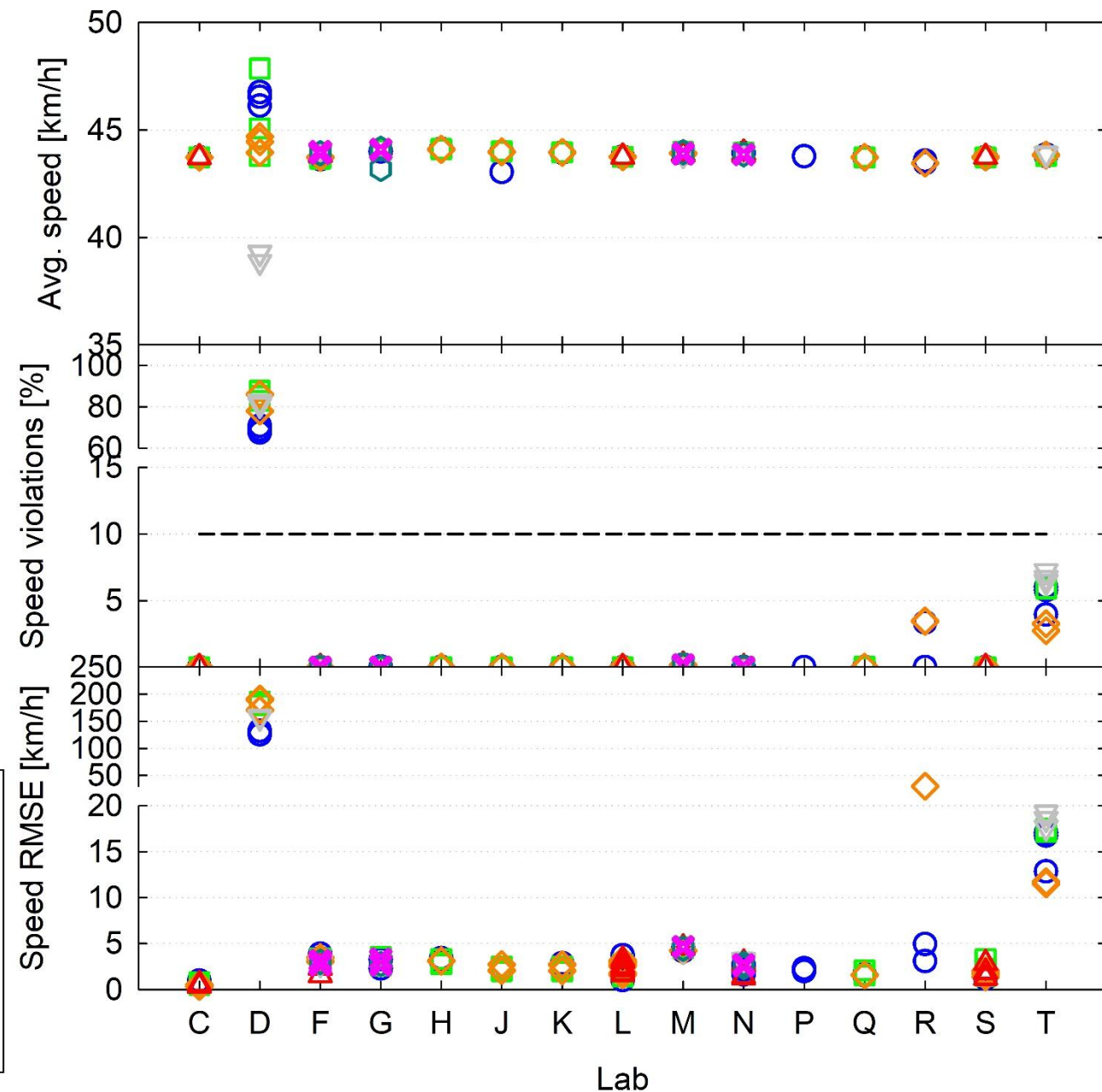
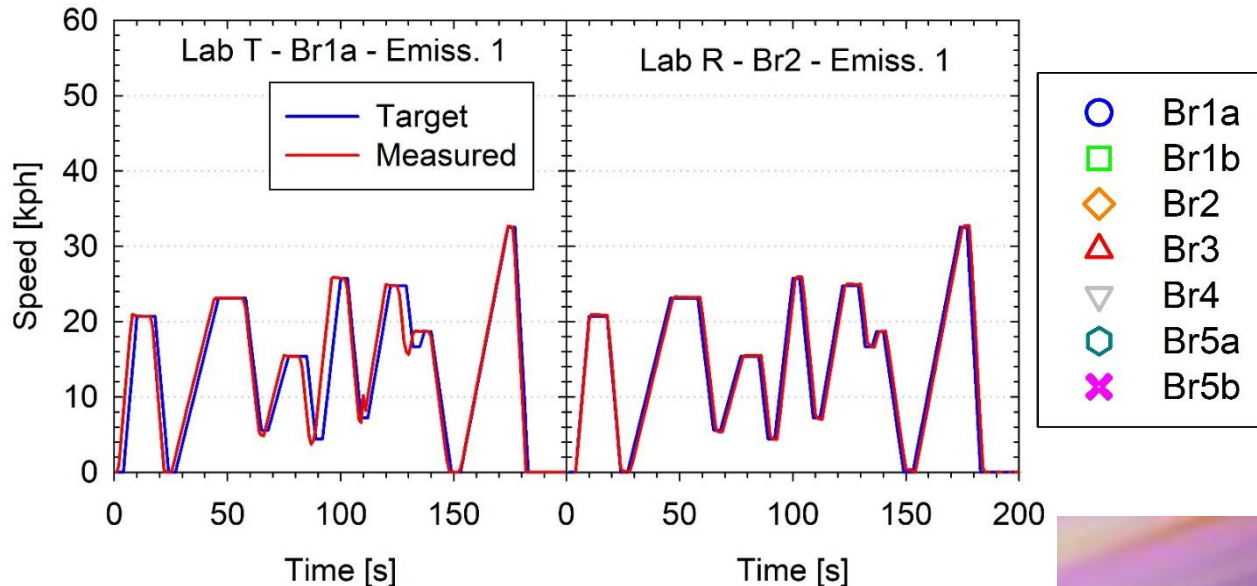


Summary

- Large data-set provides valuable information on the application/implementation of the test protocol and potential amendments to either:
 - Tighten specifications:
 - Leak checks and specifications on flow measurement accuracy
 - Upper limits on background number concentrations
 - Lower limits on PN dilution requirements
 - ...
 - Relax specifications:
 - Alignment with exhaust regulation on tunnel humidity (absolute vs relative)
 - ...

Vehicle speed

- Lab D had problems with EED exports.
- After time alignment labs R and T seem to have issues with speed violations.
 - Speed profiles from both labs suggested slight shifts of individual braking events, but violations remained always below the 10% target.
 - Accuracy of results is also somehow hindered by 1 Hz data export



Disc temperatures overview

- Average disc temperatures were within the thresholds for all tests, besides Br2 at lab Q (42-44°C < 50°C).
- Lab N provided inconsistent temperature measurements between official and AB testing

