TMDFRICTION
A NISSHINBO GROUP COMPANY

TMD Friction Group

EU7 from the perspective of a brake pad manufacturer

AVL TechDay: 07.03.2023
Philipp Nyhof

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About TMD Friction Group

TMD Friction Group – AVL TechDay 2023
TMD Friction – a 100% Nisshinbo Holdings subsidiary

TMD Friction Group – AVL TechDay 2023
Global Presence TMD Friction

Functional Headquarters	**Leverkusen (Germany)**
Employees	**~ 4,700 worldwide**
Production	**Brake Pads, Brake Linings**

Europe
- 3,375
- 8
- 1

Americas
- 759
- 2
- 1

Asia
- 362
- 2
- 2

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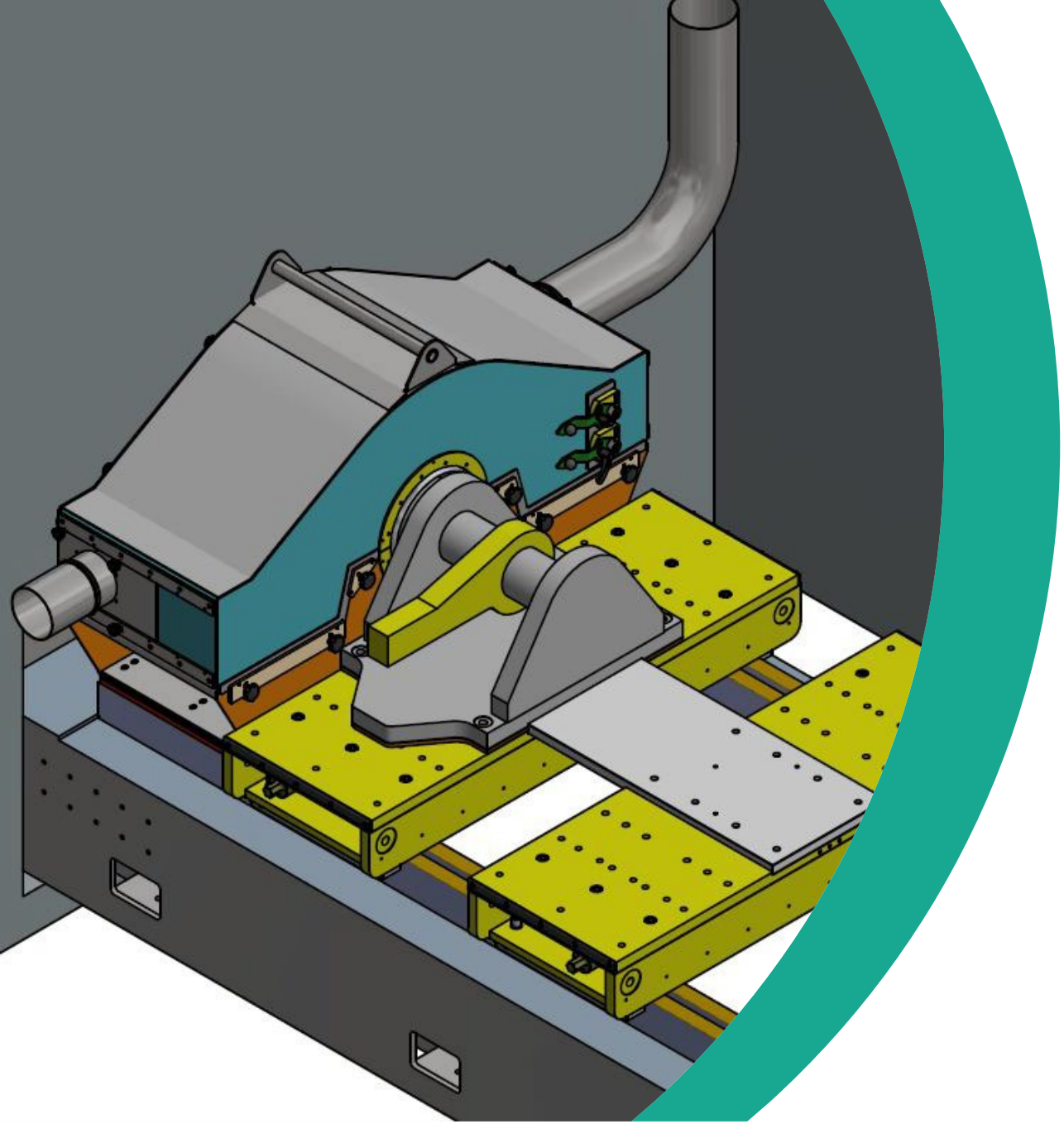
Dedicated Customer Focus

2

Challenge Euro 7

Complete Market Change



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EU7: Participation in the PMP Group

TMD is taking part in PMP (international particle measurement group of the UNECE) activities and of it's task forces on the topic of brake emissions since 2016

TMD participated in the PMP group's round robin (Task Force 3, early 2022) and all mandatory brake systems of this interlaboratory study were tested

TMDs current brake emission measurement equipment is not compliant with the published GTR (GRPE/2023/4)

Start of brake emissions measurement at TMD in Leverkusen at the end of 2023 according to GTR standard

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EU7: Passenger Cars Sector

According to the first draft of the EU7 from July 2025 **every** new registered M1 and N1 vehicle have to meet the brake emission limits

Current known limits only refer to the measured value for the particle mass of the particle size PM10 (limit = 7 mg/km/vehicle)

Further limits for particulate mass (PM2.5) or particle number have not yet been published, but could also become part of the legislation

Due to this upcoming regulation, it is necessary to adapt the entire braking system and develop new solutions to comply with brake emission limits.

M1 = Vehicles for the carriage of passengers with a maximum of eight seats in addition to the driver's seat
N1 = Vehicles for the transport of goods with a permissible total mass of up to 3.5 tons

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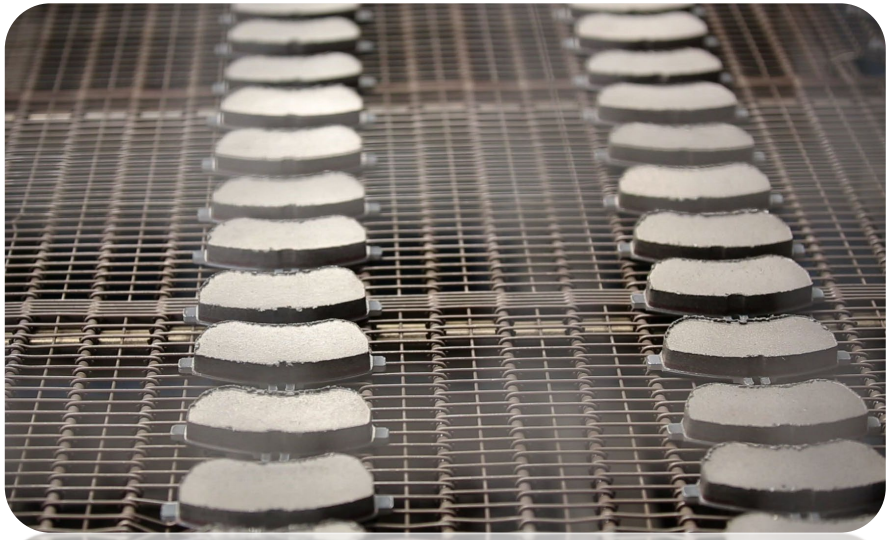
EU7: Passenger Cars Sector → Technical Development for EU7

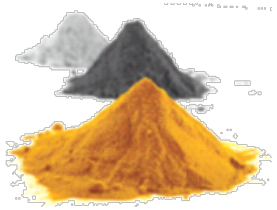
Development of new material concepts to reduce the wear and the brake dust of the brake pads



Conclusion: New solutions need to be developed as there is no off-the-shelf solution to meet brake emission limits with a friction couple of grey cast iron disc + brake pad

- Further development and adaption of friction materials
  - Low Steel
  - NAO

- Research on completely new material concepts



- Investigations on testing concepts to correlate the pad and disc wear with emission results in order to save time during development projects

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EU7: Passenger Cars Sector → Technical Development for EU7

Material development for coated brake discs

[1]

Conclusion: With laser cladded discs the particle mass can be reduced significantly. This leads to particle mass results in the range of PM10 = 1 mg/km/brake.

*FM = Friction Material

- Intense R&D activities since 2020
- Over 15 active projects with different coating solutions
- Cooperation with OEMs, OEs, disc and coating system manufacturers, powder suppliers and universities

- Multitude of different new friction couples in the market in a variety of applications
- Adaption of FM* to the new chemistry of the coating
  - Brake dust
  - Friction level, performance (also wet conditions)
  - Corrosion resistance
  - NVH
- Development of coatings is progressing steadily

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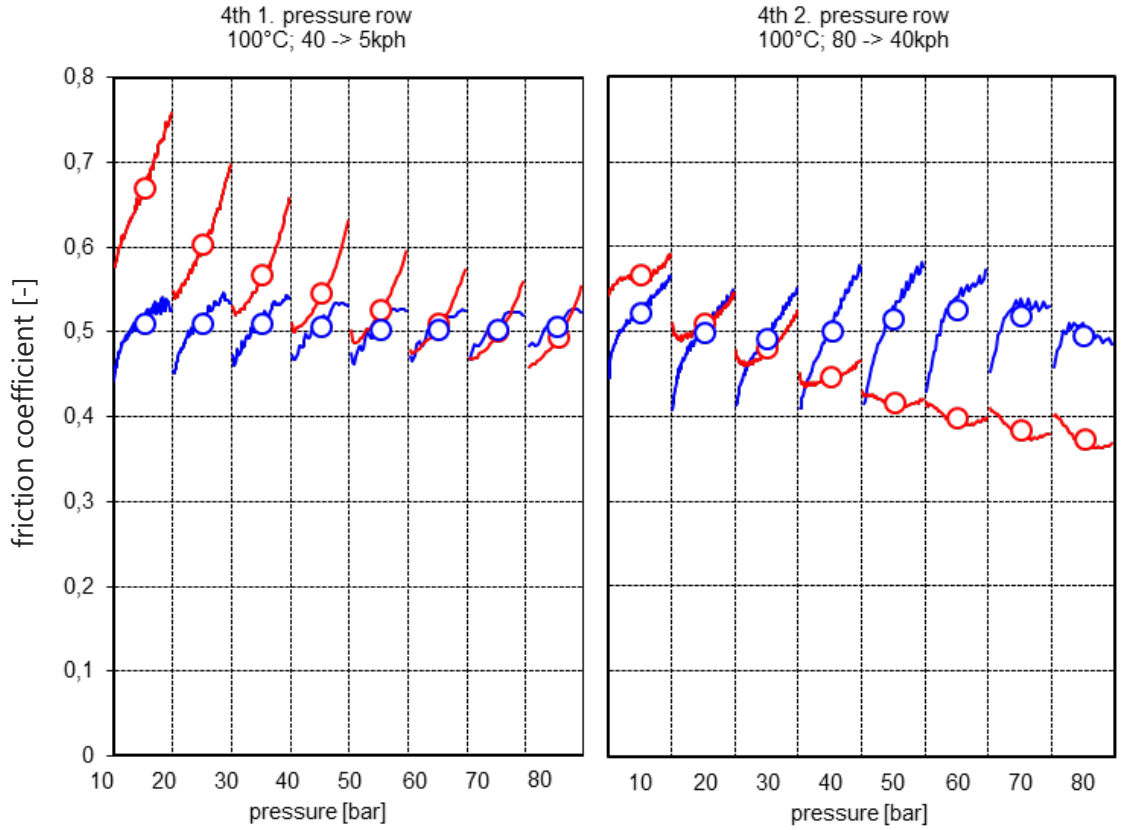
EU7: Passenger Cars Sector → Challenges with laser cladded discs

- In addition to the brake emission limits, friction couples with laser-cladded or other coated discs have to comply with the existing performance requirements
- Due to the new surface of the brake discs the following effects could generally be identified:
  - Higher pressure and friction work dependency (see diagram)
  - High drop of the friction coefficient under wet conditions
  - Changes in NVH results
- All these topics need individual adaption of the brake pads to fulfil the customer requirements



Friction coefficient: GCI disc + GCI brake pad

Friction coefficient: Laser cladded disc + GCI brake pad

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EU7: Commercial Vehicles

According to the first draft of the EU7 from July 2027 **every** new registered M2, M3, N2, N3 vehicles and O3, O4 trailers have to be comply with the EU7 regulation

No limits have yet been published for this vehicle sector

At the moment there is no GTR in progress for the CV market

TMD is already working preventively on brake dust reduction with CV brake pads and initial tests have been carried out with coated discs

M2 = Vehicles for the carriage of passengers with more than eight seats in addition to the driver's seat and a maximum permissible mass of up to 5 tons
M3 = M2 but more than 5 tons
N2 = Vehicles for the carriage of goods with a maximum permissible mass of more than 3.5 tons and up to 12 tons
N3 = N2 but more than 12 tons
O3 = Trailers with a maximum permissible mass of more than 3.5 tons up to 10 tons
O4 = O3 but more than 10 tons

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EU7: Independent Aftermarket

It is unknown when and to what extent aftermarket brakes, brake pads or brake rotors will be affected by the new legislation.

There are task forces working on a proposal for homologation of aftermarket products, as there will be a large number of possible combinations on the aftermarket, all of them having to comply with the EU7 limits for brake dust.

TMD is also part of these working groups

Also in this segment, TMD has begun reviewing its aftermarket portfolio for coated brake discs.

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EU7: Racing

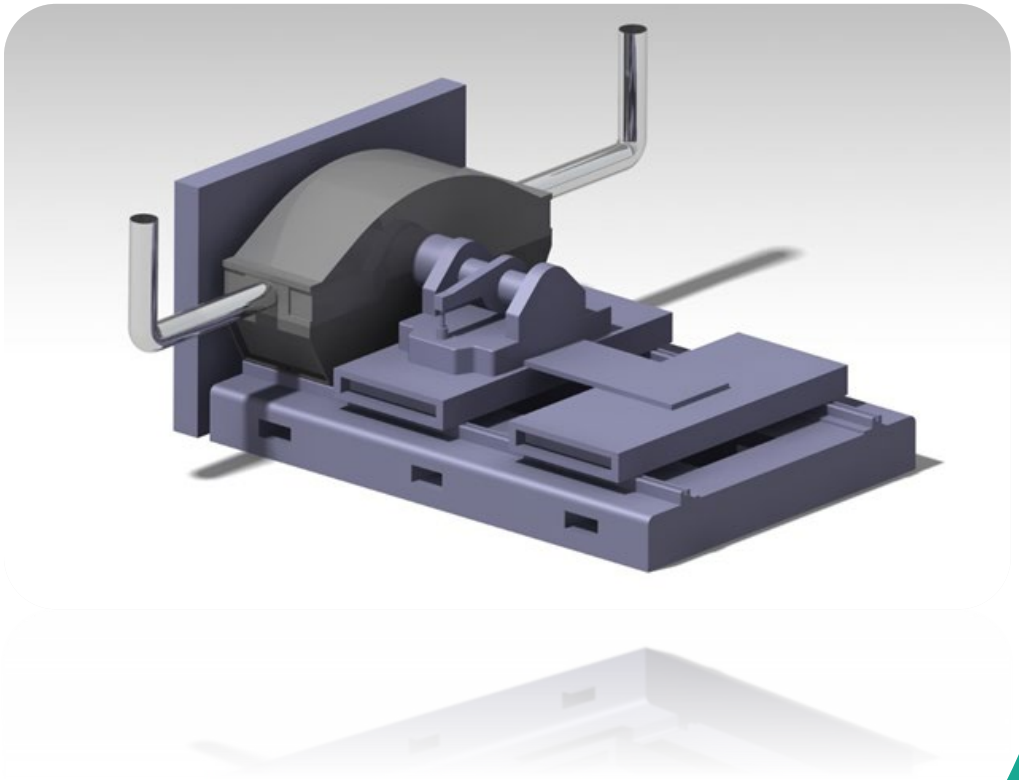
Neither the GTR (GRPE/2023/4) nor the first draft of the EU7 proposal apply to vehicles used in closed areas such as racing circuits

"The UN GTR does not contain test requirements specific to other types of vehicles e.g. off-road, special purpose, and heavy-duty vehicles" [2]

But this topic is also important for racing applications:

- After the Formula 1 Spielberg Gran Prix in 2022 Sebastian Vettel publicly addressed the issue of carbon dust from the brakes
- In 2019 Valtteri Bottas reported about black dust in his nose [3]

In cooperation with TMDs technical partners and teams first studies are running to reduce brake dust in racing applications



TMDs point of view of the current version of the GTR and the EU7 draft

GTR:

- With the release of the UN GTR on Laboratory Measurement of Brake Emissions for Light-Duty Vehicles the industry is able to work
- Certainly there are some open topics with this GTR
  - E.g. this version was not validated in a further round robin test, so it is not clear whether the new spec. will lead to more consistent results

EU7 draft:

- Timing is very tough
- Lead time necessary to build up testing capacities to test according the GTR
- Open questions regarding homologation process concerning the independent aftermarket

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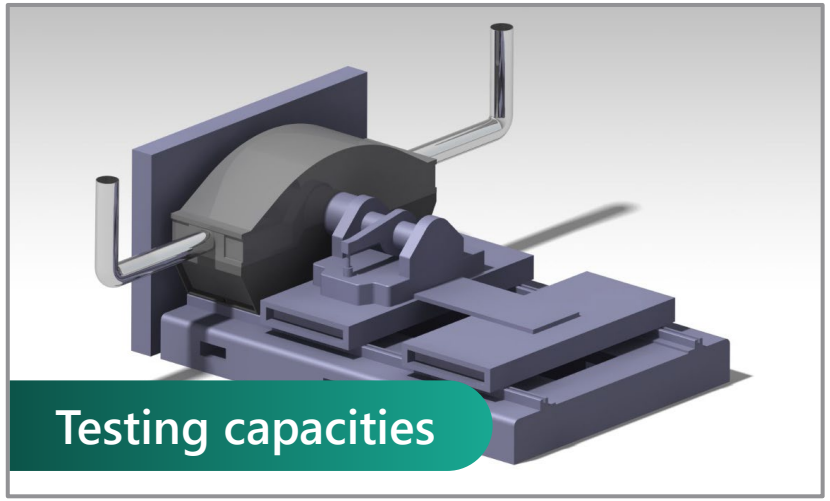
Challenge of EU7



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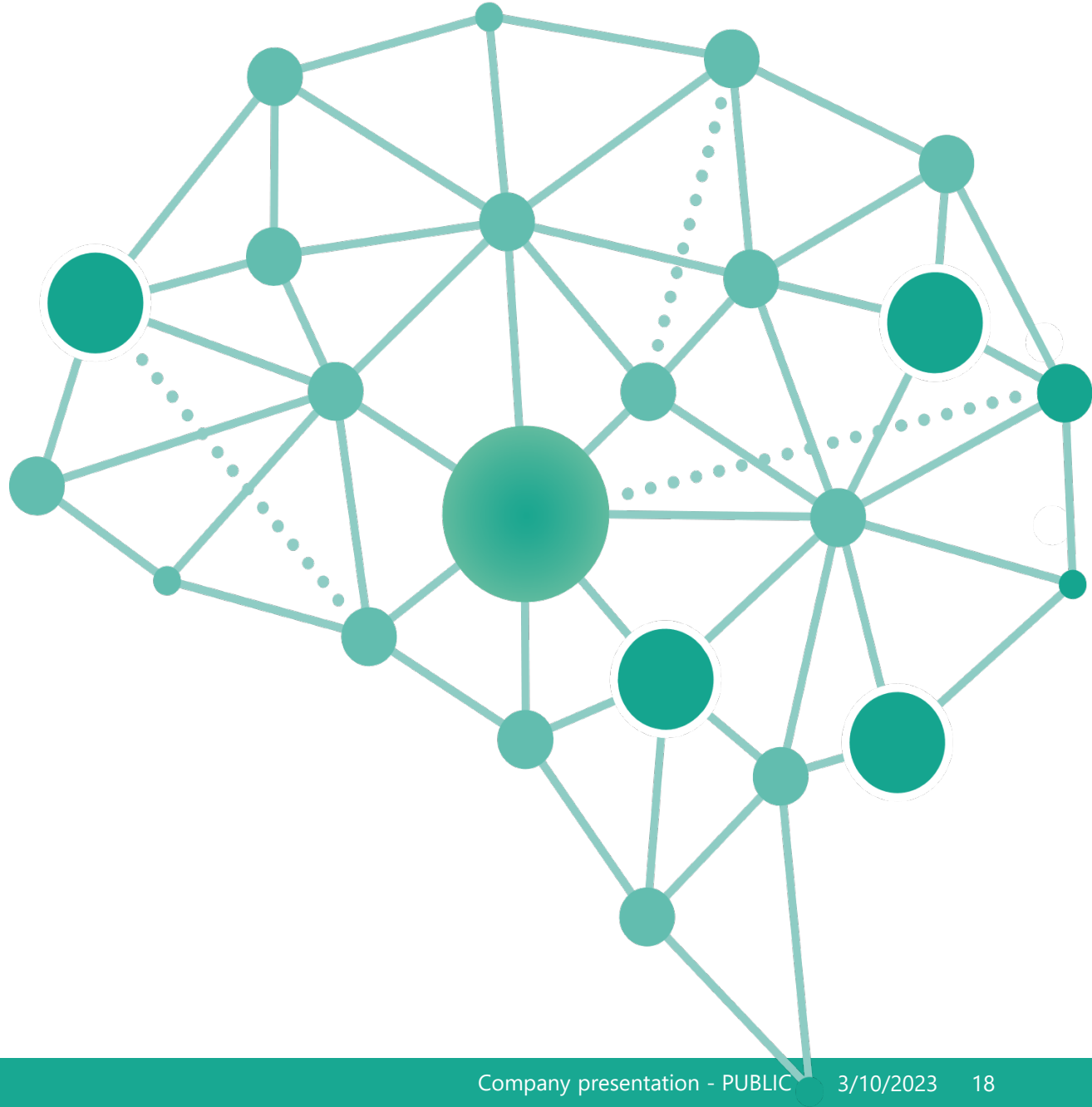

List of references

[1] Lannert, V. 2019. https://www.fraunhofer.de/de/presse/presseinformationen/2019/september/bremsscheiben-effektiv-schuetzen-durch-neues-fraunhofer-beschichtungsverfahren.html

[2] Informal Working Group on Particulate Measurement Programme. 2023. *GRPE/2023/4 Proposal for a new UN GTR on Laboratory Measurement of Brake Emissions for Light-Duty Vehicles.* 2023. Geneva

[3] Howard, T. 2022. https://www.motorsport-total.com/formel-1/news/bremsstaub-im-gesicht-formel-1-diskutiert-mit-teams-moegliche-loesung-22071301