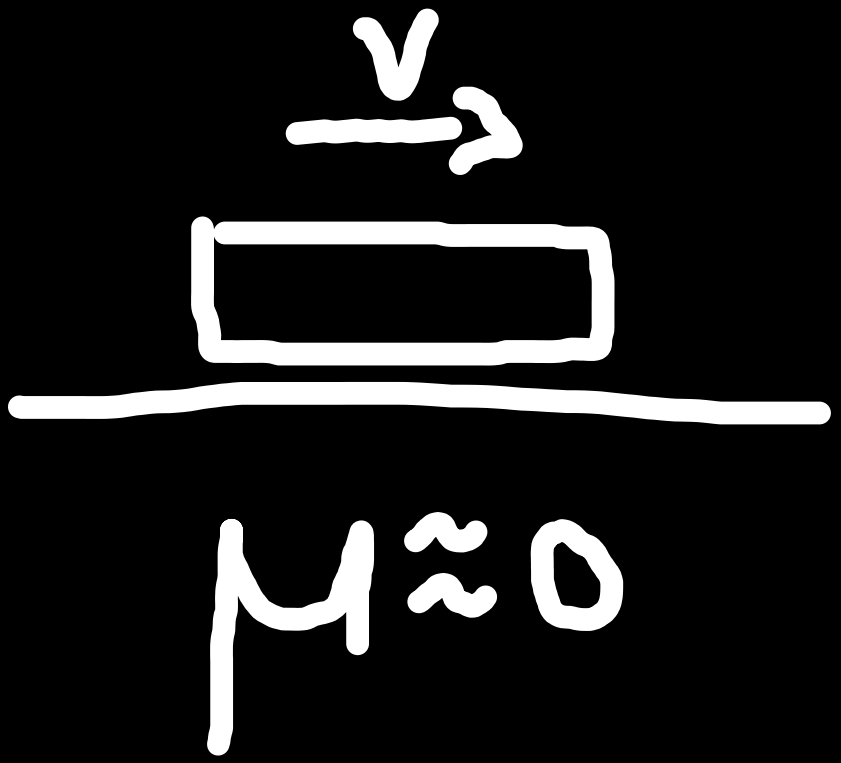
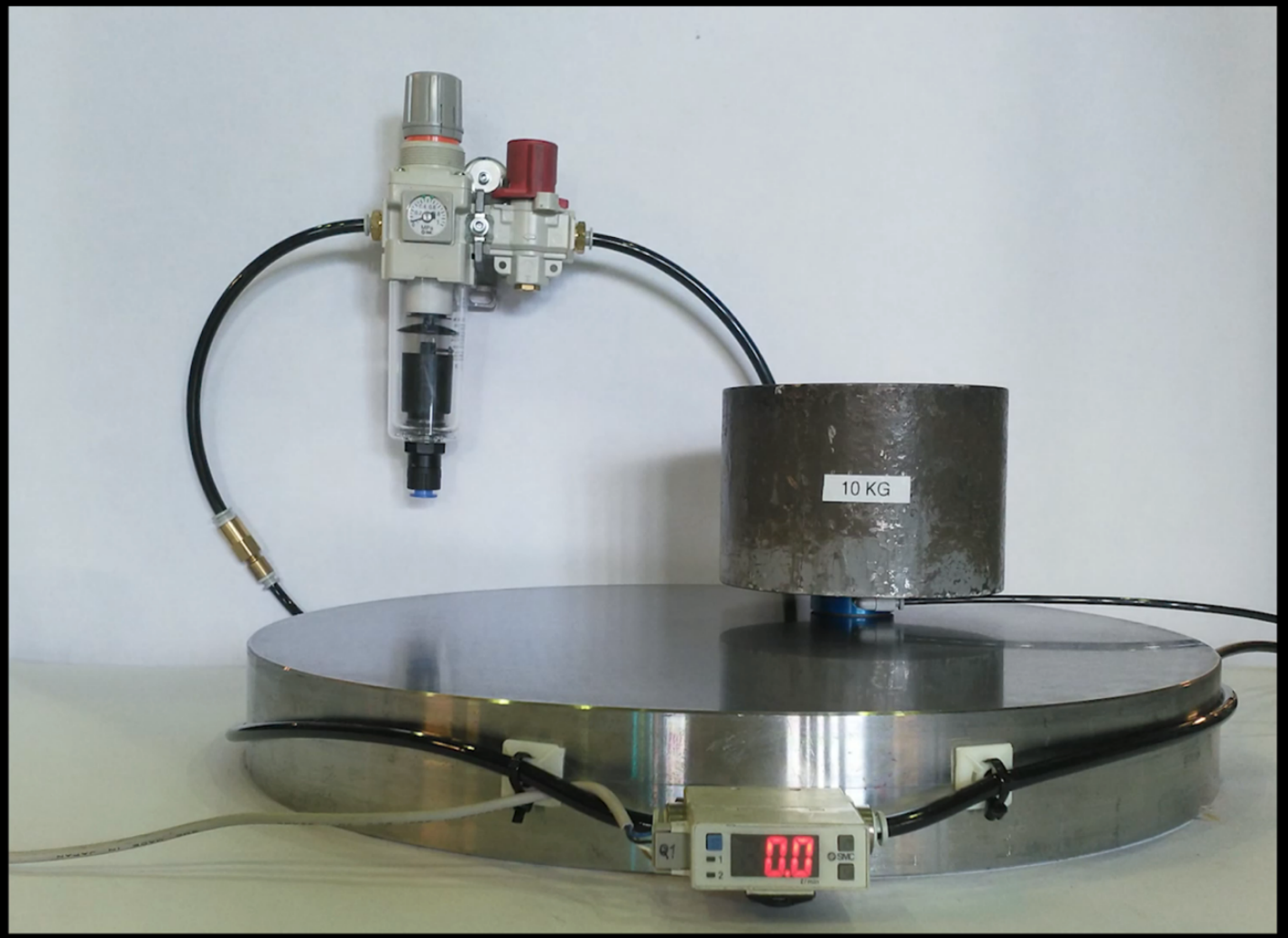
Frictionless motion: Air bearings



Mikael Miettinen & Valtteri Vainio
8.4.2021

Aalto-yliopisto
Aalto-universitetet
Aalto University

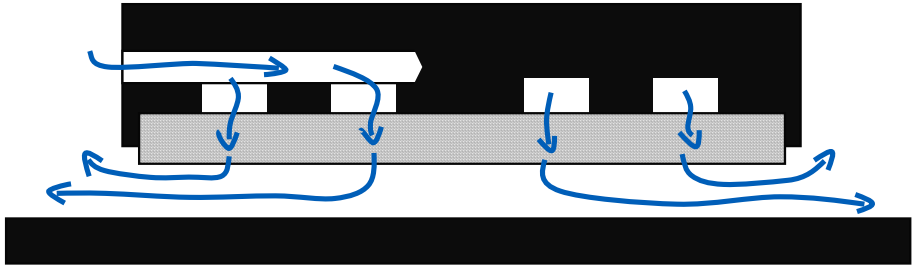

10 KG
0.0
SMC

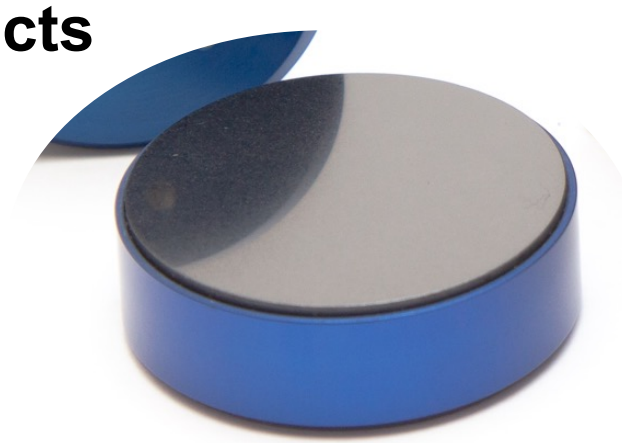
Air bearings

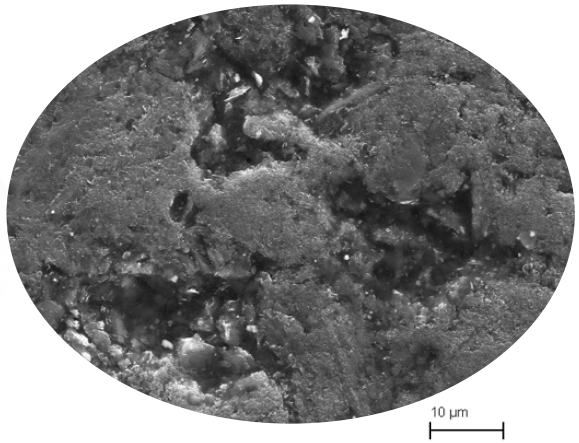
- Non-contact bearing
- Air film carries load
- High accuracy motion
- Almost zero friction

Principles

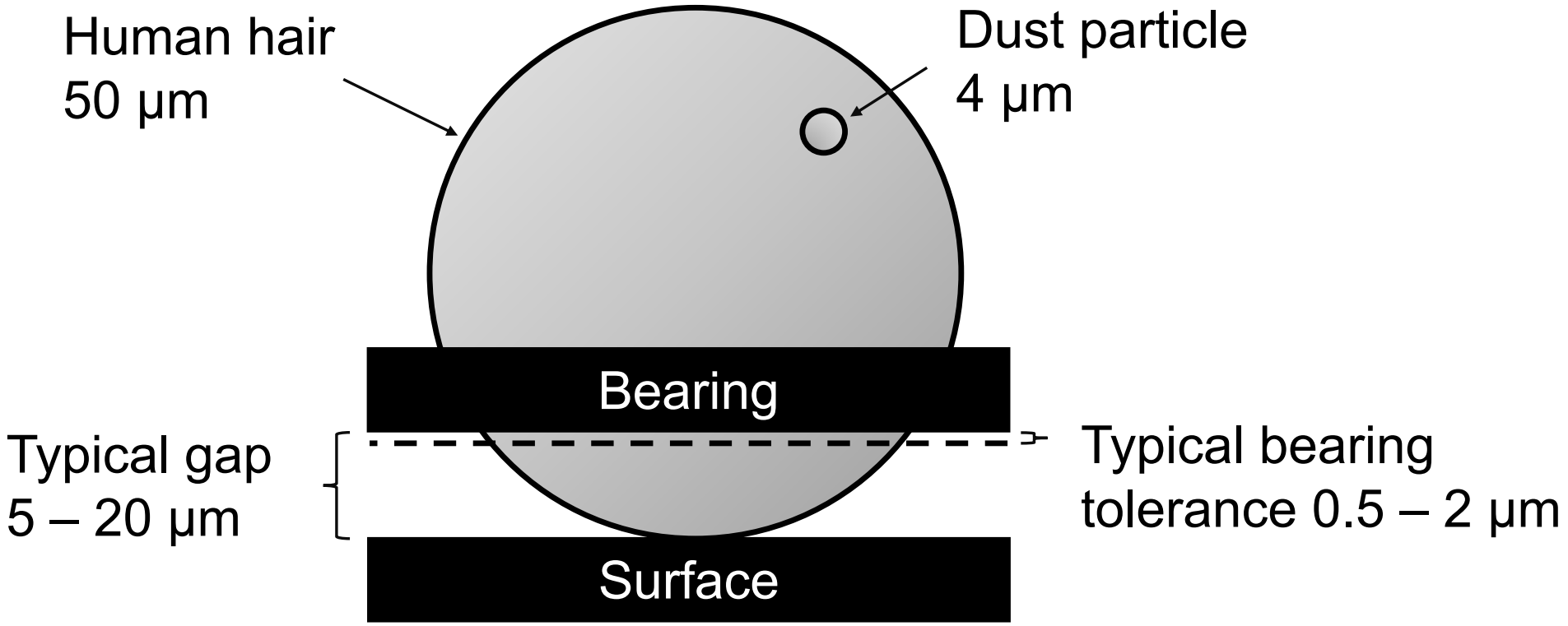
- We use externally pressurized porous material restrictors
- Pressurized air is fed to bearing gap trough restrictor
- Narrow gap further restricts the flow







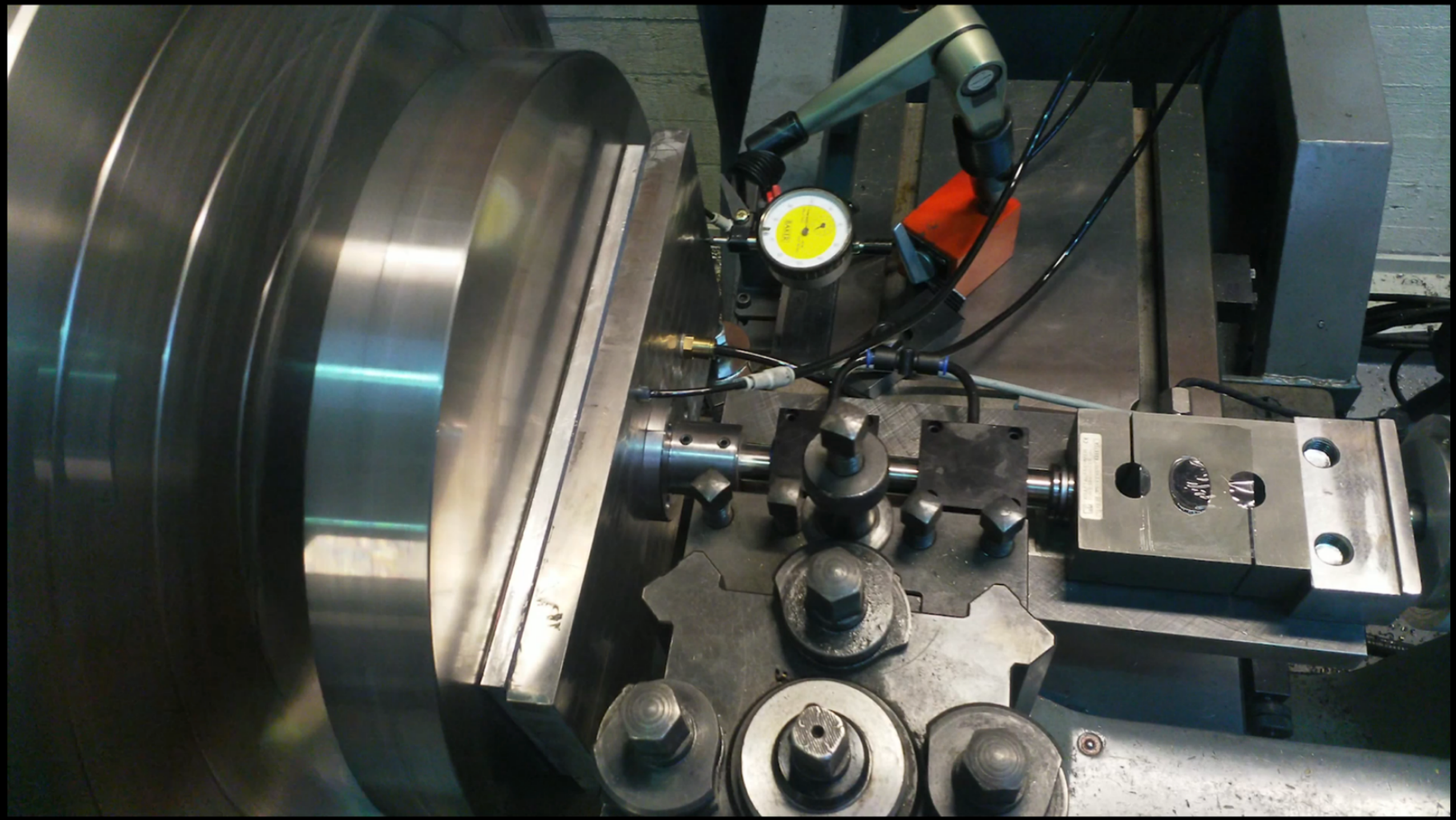
Scale


Human hair
50 µm
Dust particle
4 µm
Bearing
Typical gap
5 – 20 µm
Typical bearing
tolerance 0.5 – 2 µm
Surface


10 KG
0.0

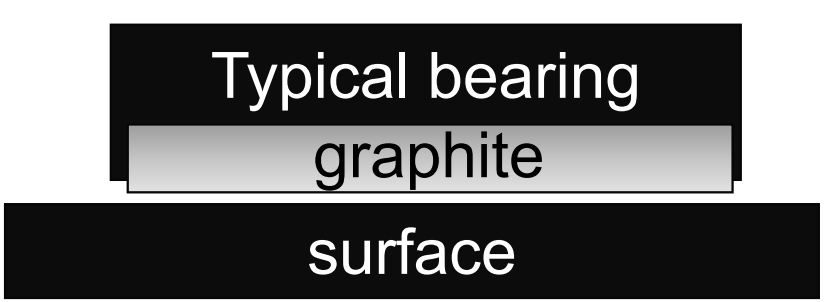
Current research

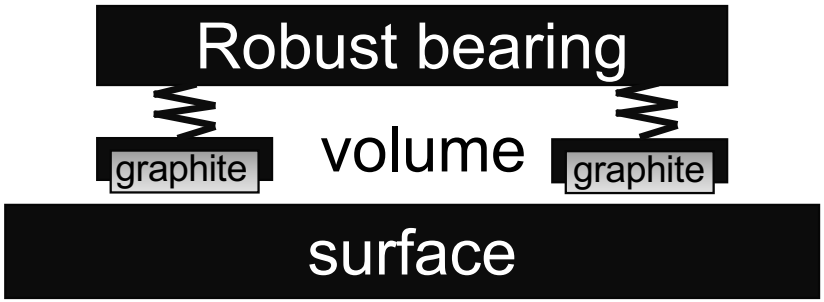
- **Development of manufacturing recipe for robust air bearings**
  - Goal “All Terrain Bearing”
- **Investigation of properties of graphite restrictors**
  - 27 combinations in porosity and manufacturing methods

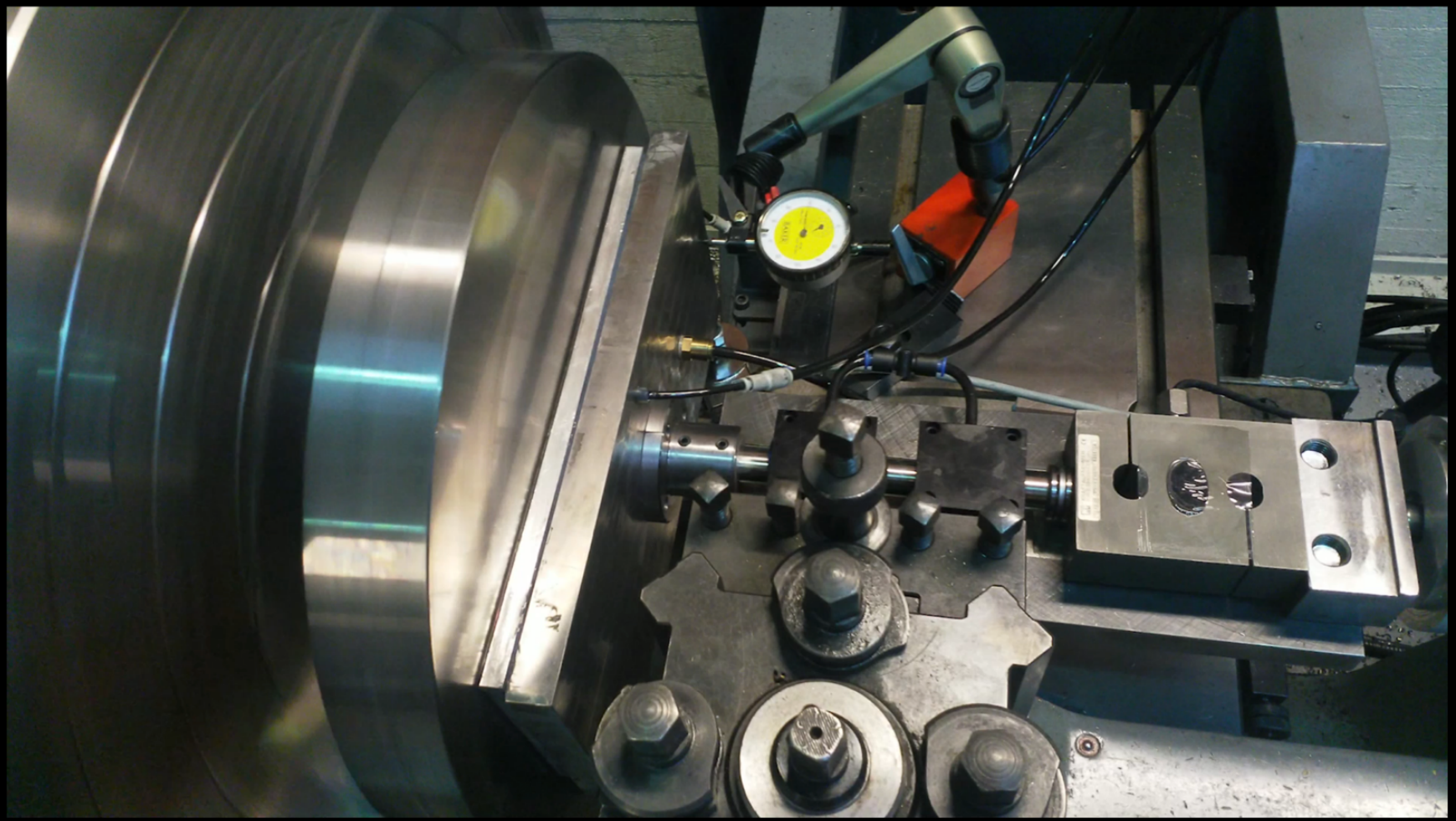


Robust bearing test unit

- **Bearing with the centre removed, compliant structure**
  - Easier to stay in tolerance
  - Flexes to follow the surface
  - Centre volume pressurized -> same load capacity, lower stiffness
- **Tested with high axial runout (1.2mm)**







Conclusion

- Air bearings can improve energy efficiency by reducing friction
- Potential applications in cardboard manufacturing

Mikael Miettinen
mikael.miettinen@aalto.fi

Valtteri Vainio
vatteri.s.vainio@aalto.fi