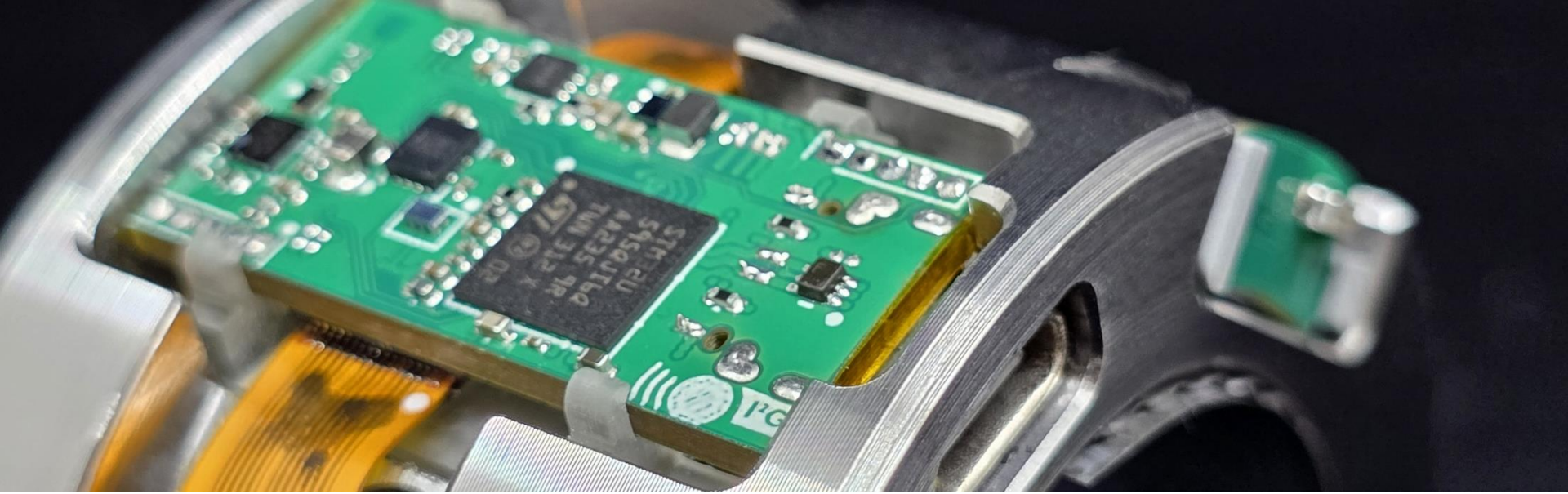




Sensor Integrating Machine Elements Congress

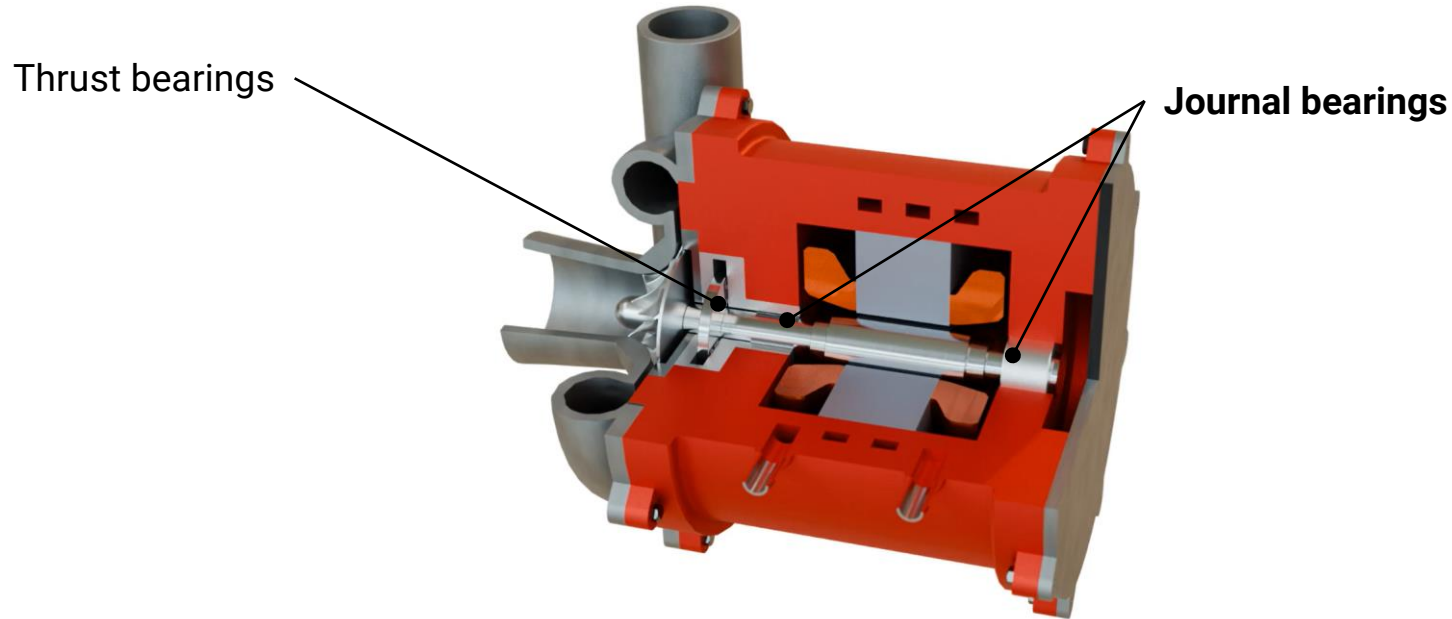


15 – 16 September, 2026 in Darmstadt, Germany

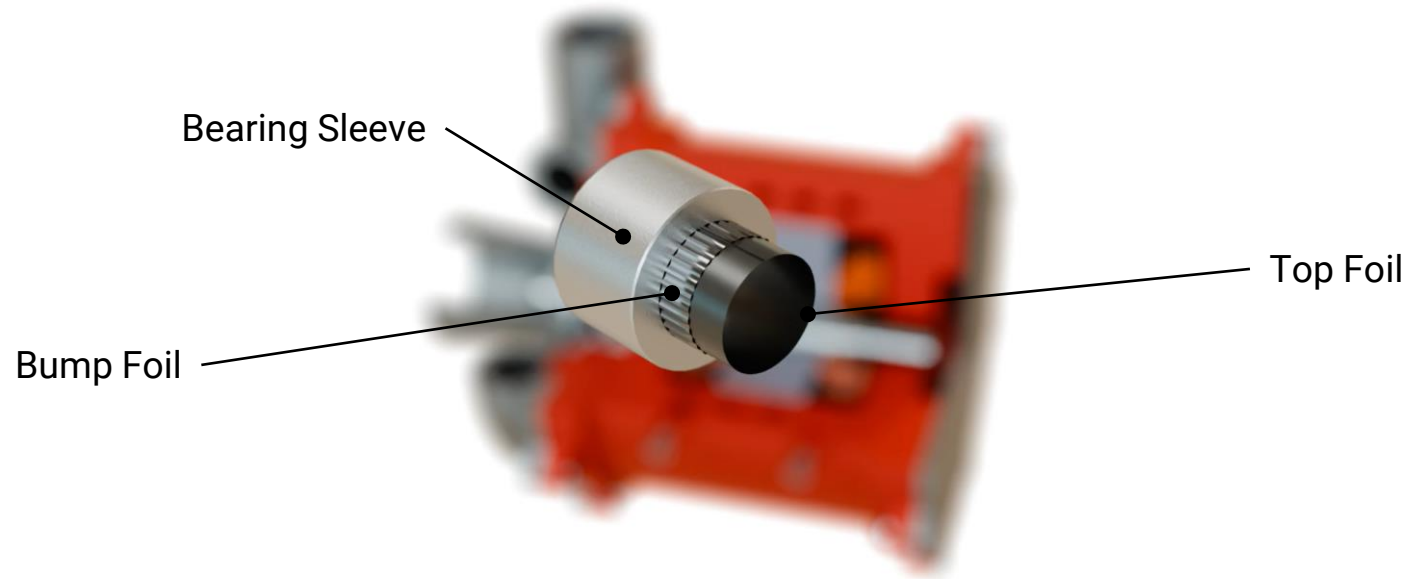
Energy Harvesting in Gas Foil Bearings

C. Gühmann, R. Liebich, **M. L. Kliemank**, M. Ahmadzadeh, J. Zimmer,

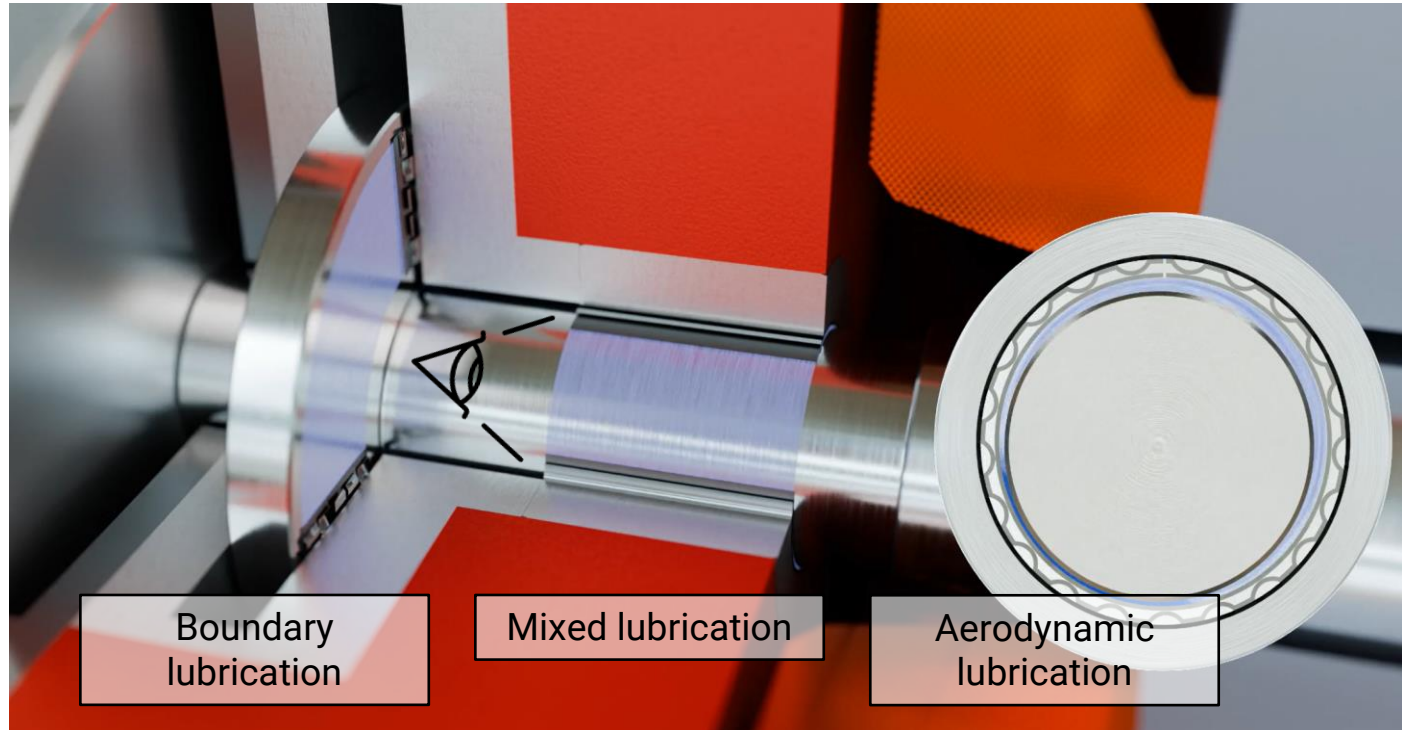
Gas Foil Bearings: Structure and Operating Principles



Gas Foil Bearings: Structure and Operating Principles

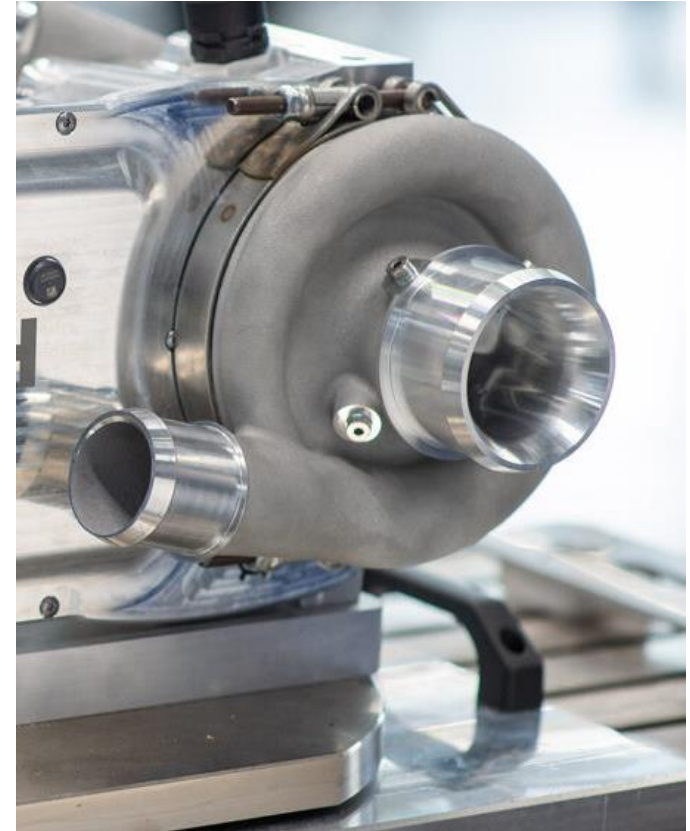
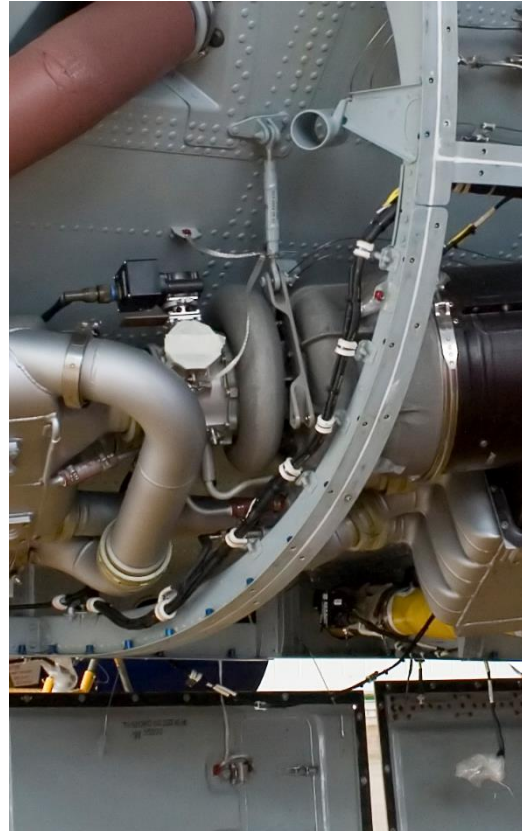


Gas Foil Bearings: Structure and Operating Principles

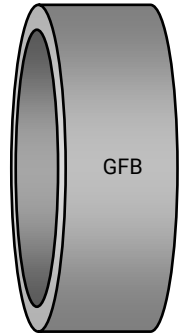


Gas Foil Bearings: Advantages and Applications

- High RPM – high power density
- No contamination of the gas
- Low friction – high energy efficiency
- Low weight and volume



GFB Challenges and SiGFBs as Basis for their Solution



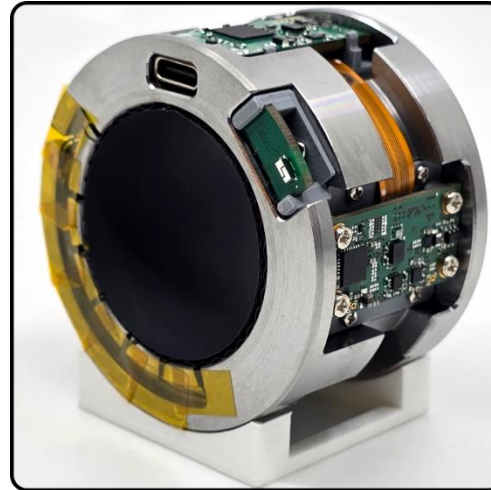
Thermal Instability



Vibrational Instability



Wear



Temperature

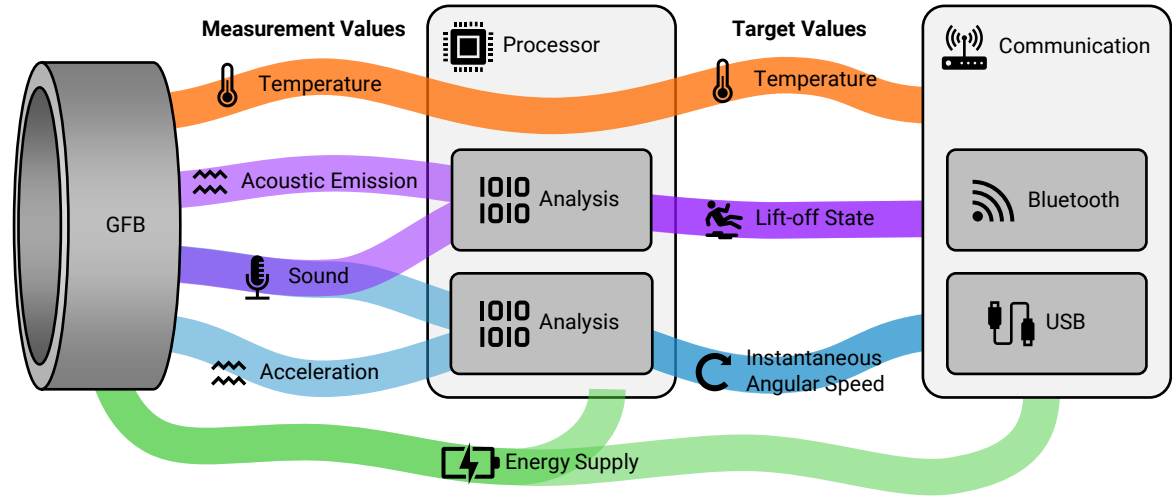
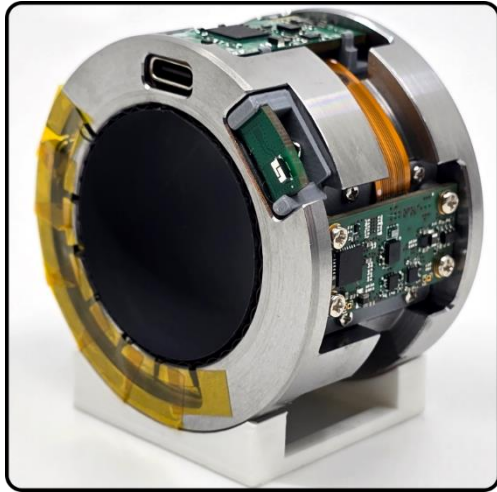


Instantaneous Angular Speed

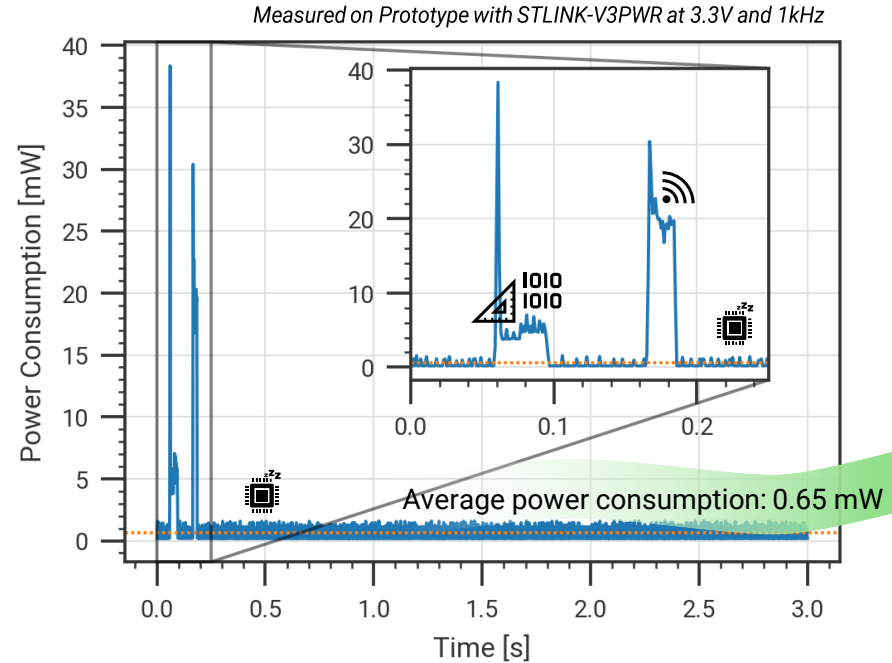
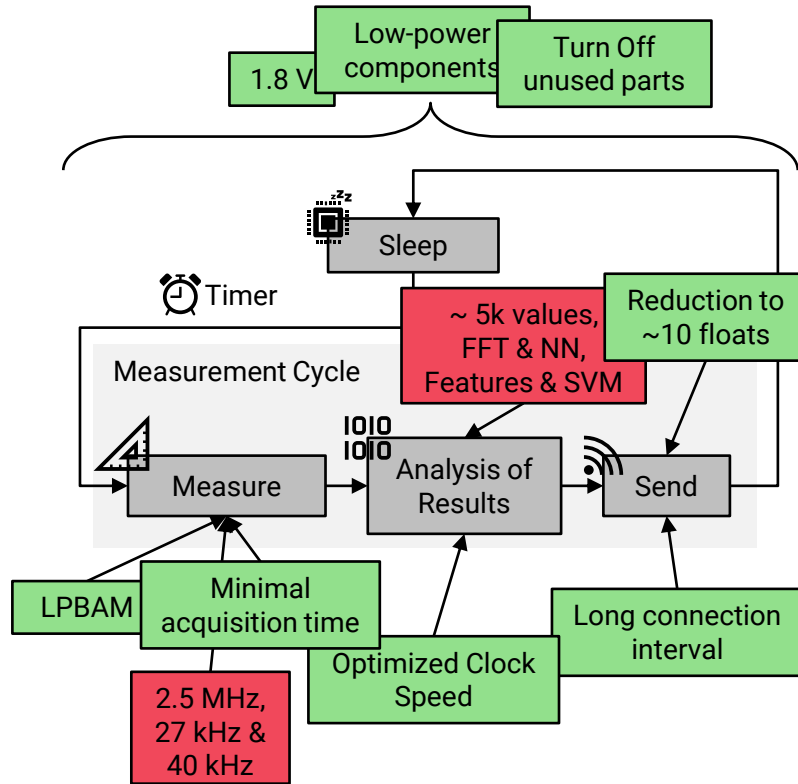


Lift-off State

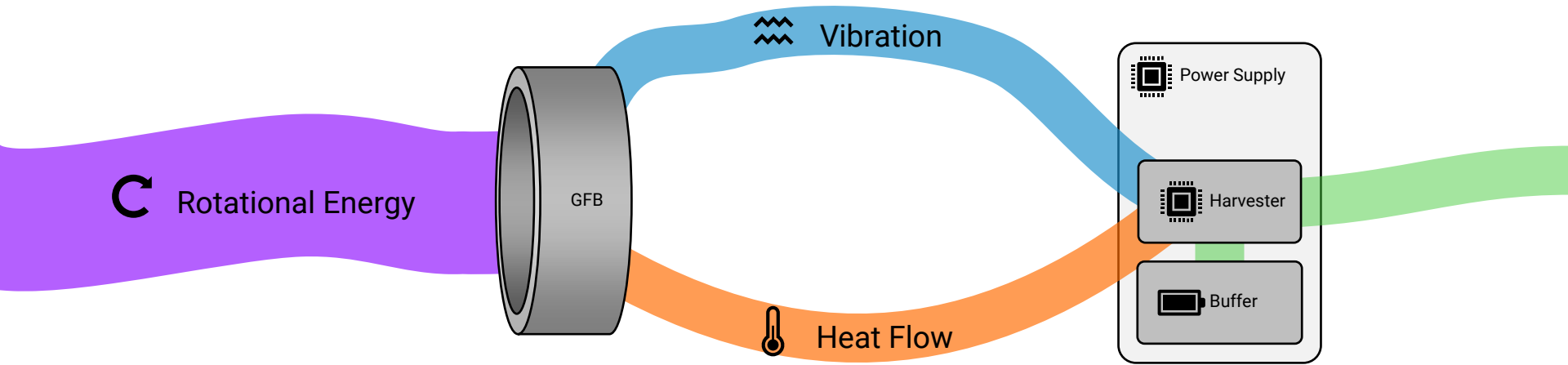
SiGFB System Overview



Energy Consumption Overview

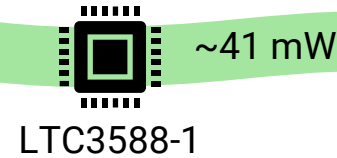


Energy Harvesting in GFBs is Challenging



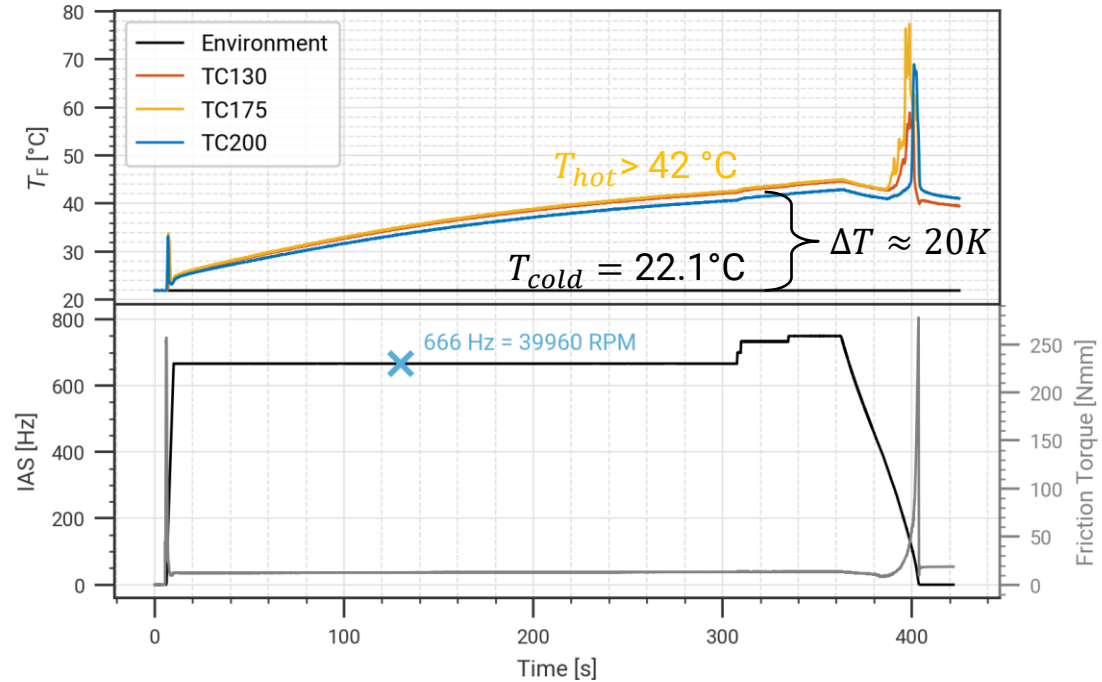
Harvesting from GFB Vibrations

- Variable-reluctance-based design
- 2D simulation: ~ 50 mW
- Potential patent under consideration
- 3D Simulation, Influence on Rotor, Prototype



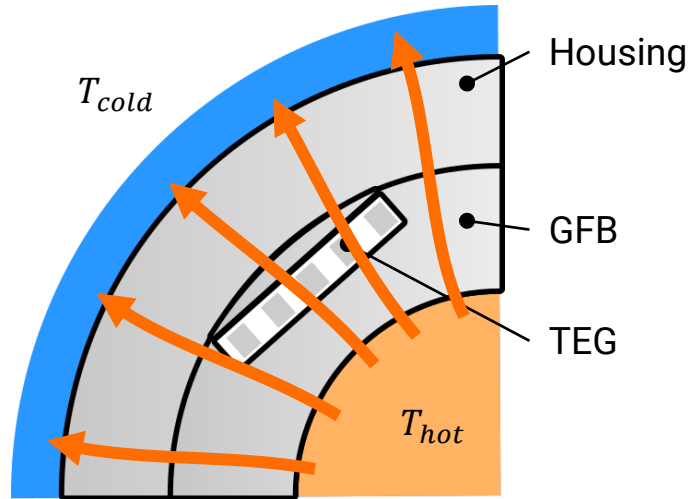
Harvesting from Heat Flow

Harvesting Potential



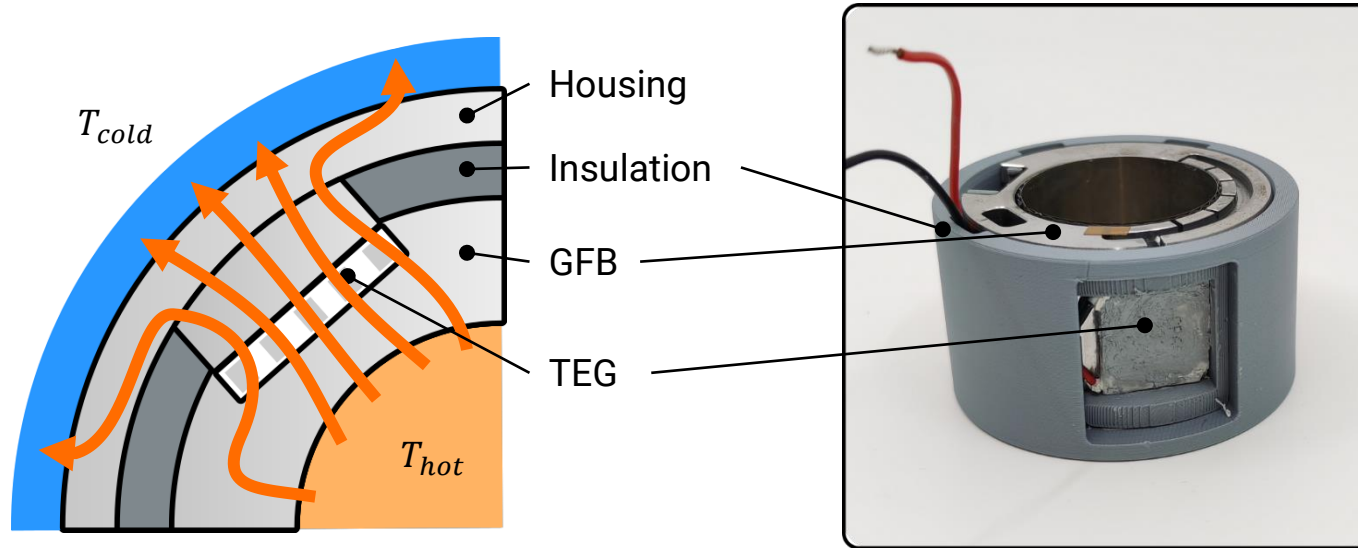
Harvesting from Heat Flow

Harvesting Approach



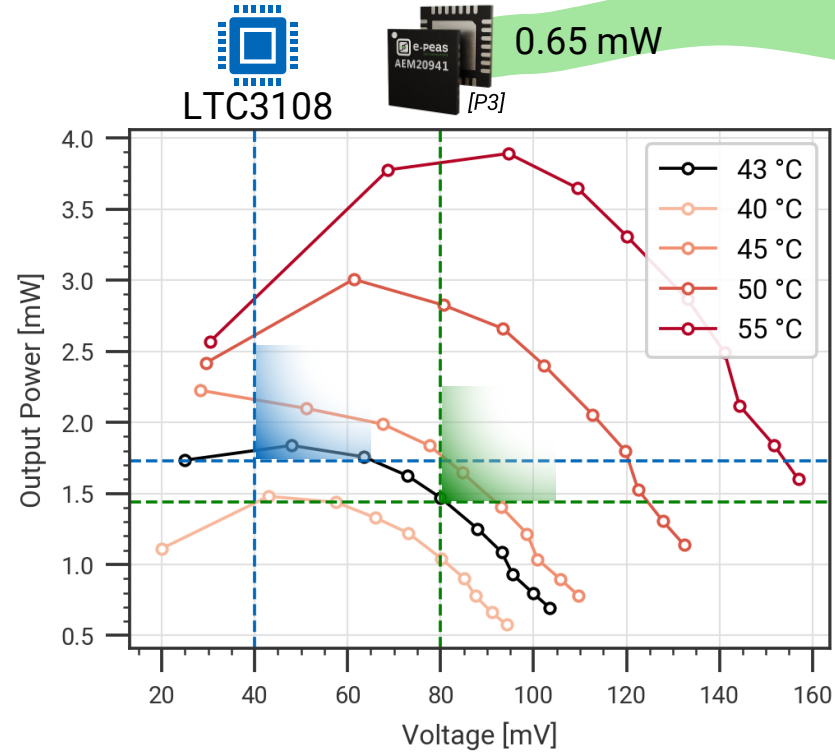
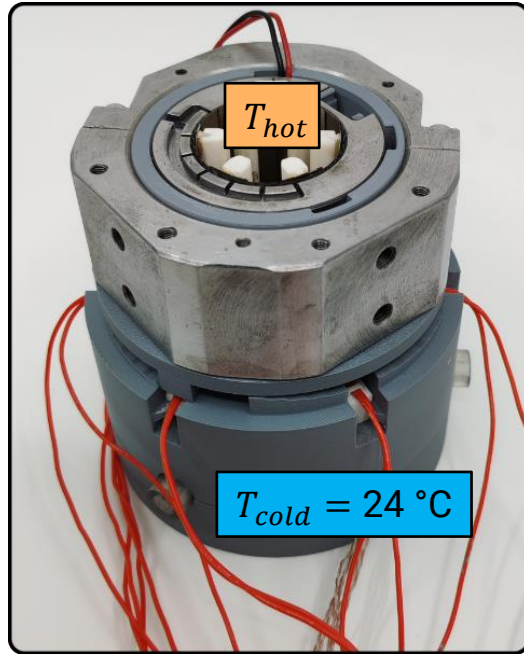
Harvesting from Heat Flow

Harvesting Approach



Harvesting from Heat Flow

Harvesting Evaluation



Harvesting from Heat Flow Outlook



- ✓ First investigation of EH in GFBs, found two approaches that do not compromise GFB function
- ✓ Both harvesting approaches promising for SiGFB

- Further investigation is needed to verify results
- Prototypical implementation for practical evaluation

Image Sources:

- [P1] Krafthand.de: Bosch liefert Luftverdichter für Brennstoffzellen-Lkw an Cellcentric , URL: <https://www.krafthand.de/truck/artikel/bosch-liefert-luftverdichter-fuer-brennstoffzellen-lkw-an-cellcentric-28438/>
- [P2] Wikimedia Commons: https://en.wikipedia.org/wiki/File:Air_conditioning_systems_of_a_Sukhoi_Superjet.jpg
- [P3] e-peas SA: AEM20941, URL: <https://e-peas.com/product/aem20941/>

Thank you for your attention!



Gefördert durch



We thank the DFG for funding the project *Standardized integral instrumentation of gas foil bearings for condition and operation monitoring (I²G)* [project number 466782279] within the priority program 2305 [project number 441853410].

We thank our student assistant, Joseph Zimmer,
and thesis candidates, Gert Ruka and Patrick Vural, for their contributions to the project.

Majid Ahmadzadeh, M. Sc.
m.ahmadzadeh@tu-berlin.de
Technische Universität Berlin

Martin Kliemank, M. Eng.
m.kliemank@tu-berlin.de
Technische Universität Berlin