DESY. QUANTUM

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HUMBOLDT-UNIVERSITÄT ZU BERLIN

MAX-PLANCK-INSTITUT FÜR KERNPHYSIK

Status update: Phase Noise Cancellation Test Setup

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Thursday, 6th March 2025 — DESY / HU / MPIK / Birmingham Meeting

Outline

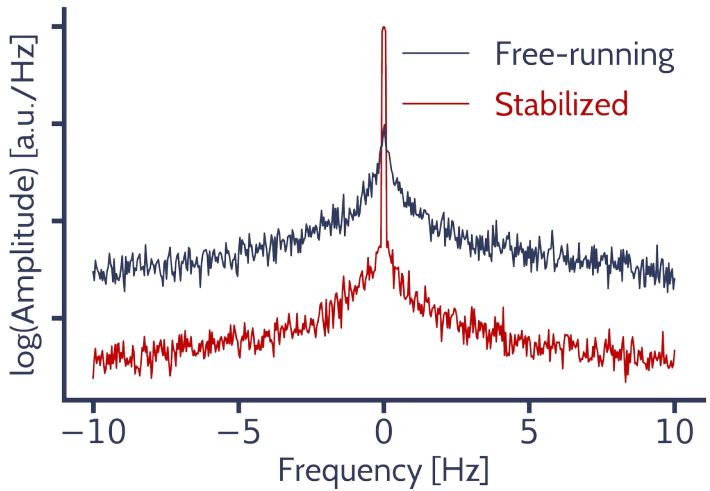
- Basic principle of PNC
- **Test setup in our lab**
  - Results
  - Open questions and outlook

Phase noise from fiber transmission

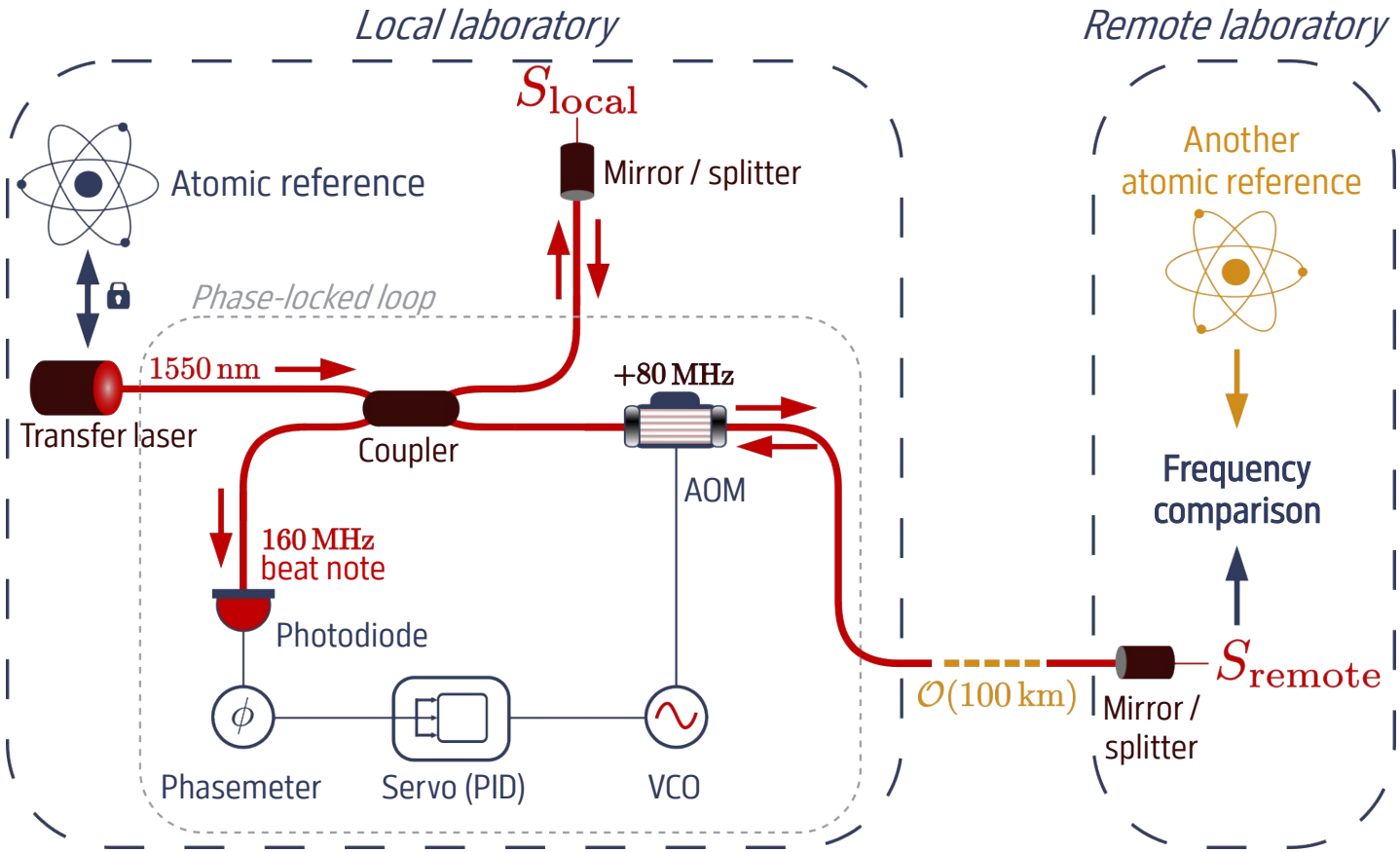
- Clock comparison requires **frequency transmission: usually via fiber @ 1550nm**
- Vibrations, temperature fluctuations, optical components, …

→ Phase noise ≙ **frequency instability**

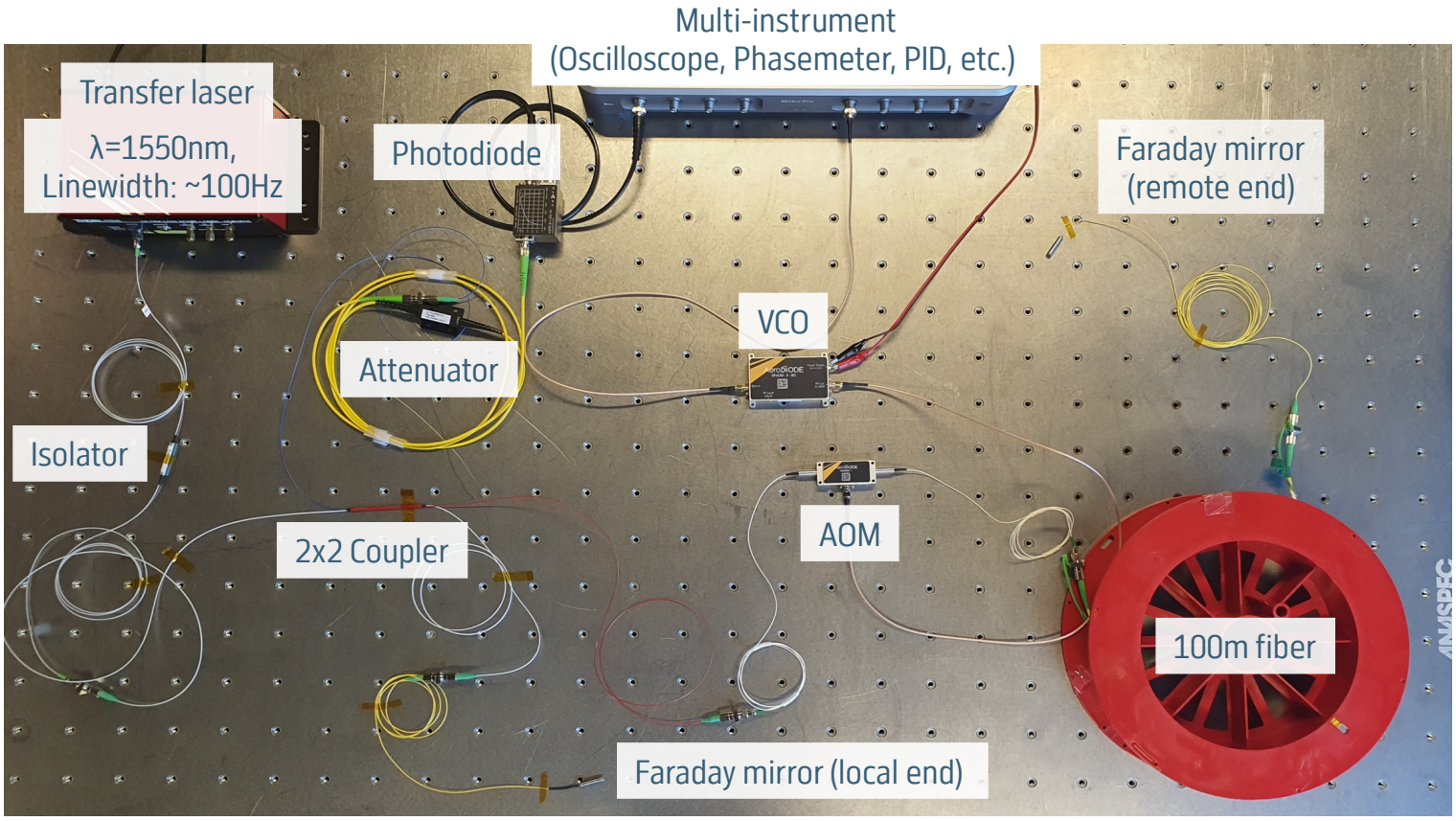
Goal:



Phase noise cancellation (PNC)



PNC test setup stand

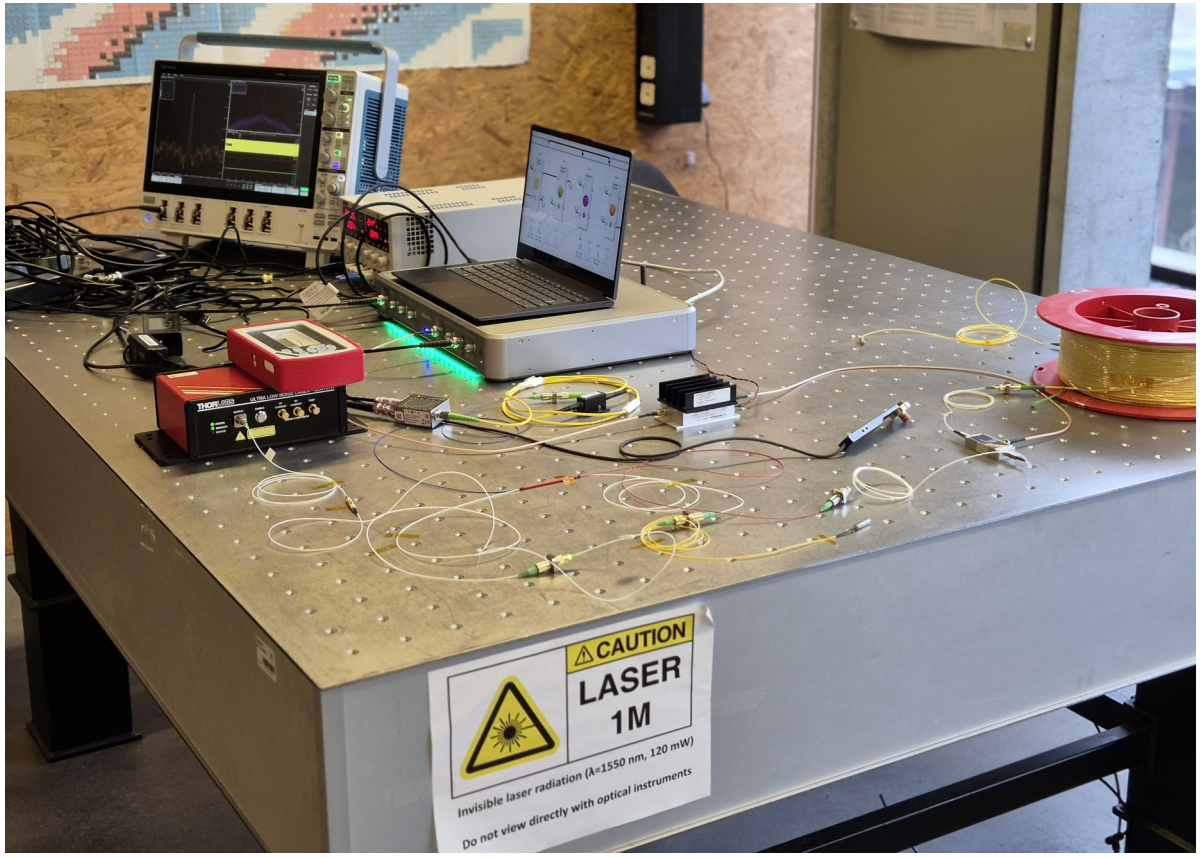


Fiber Michelson-interferometer uses RF beat note to identify & correct for phase noise

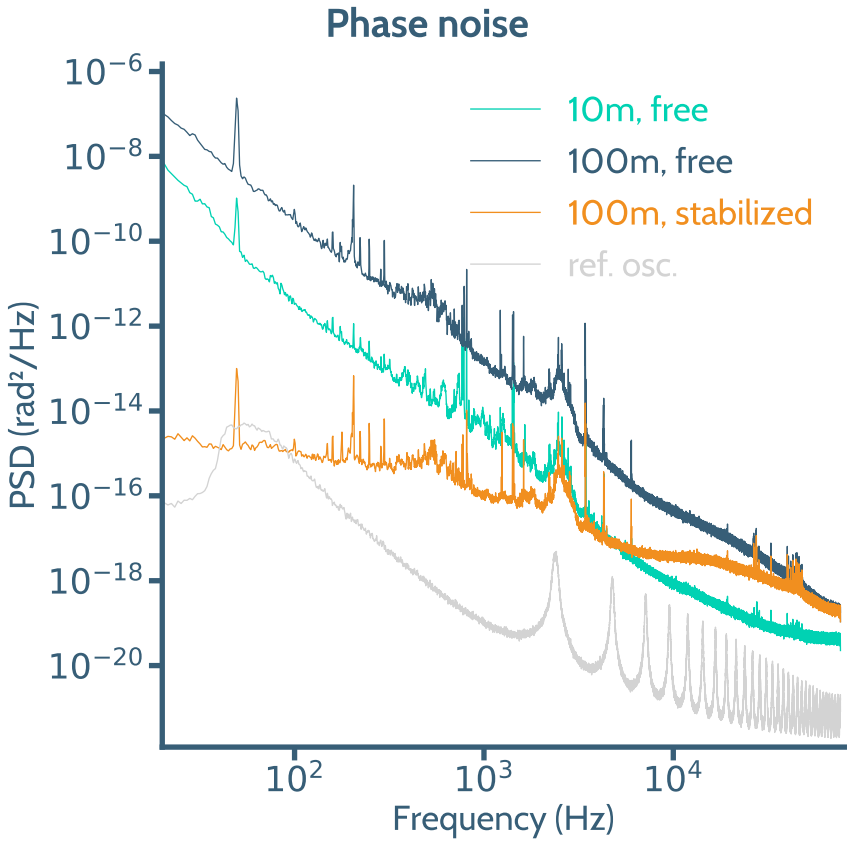
Fiber-based phase noise cancellation:

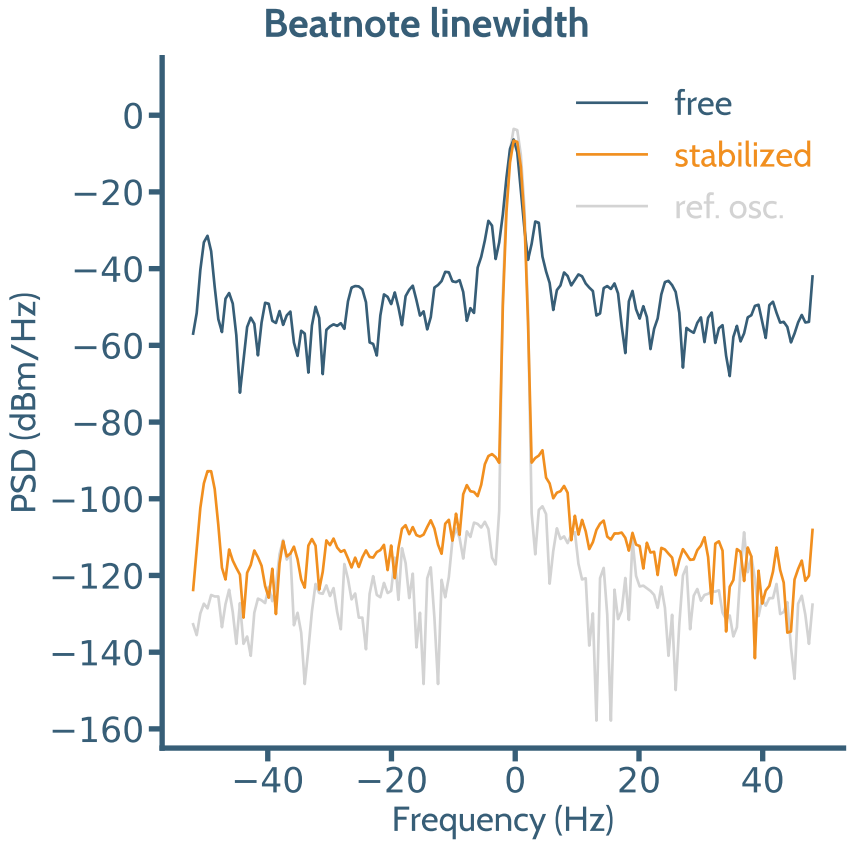
Easier to handle and reproduce than **free-space optics**

PNC test setup stand

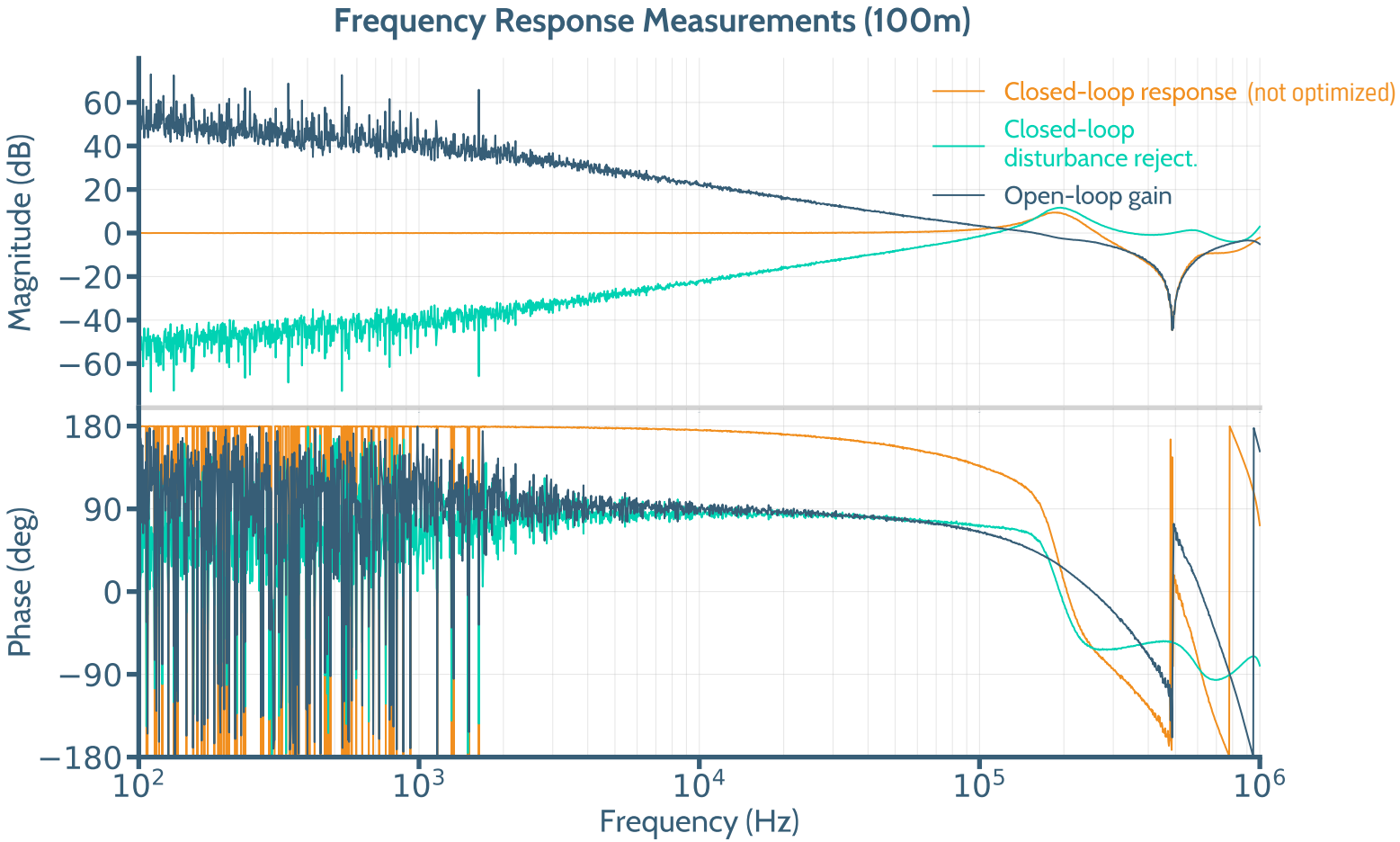


PNC test setup: Performance





PNC test setup: Characterization



Goals and open questions

- Optimize loop-settings?
- Understand contraints better
- Identify necessary performance

} **Test setup ↔ Real world case**

→ need **input from an expert**

Thanks for your attention!