Status of the T9.3 activities in Oxford

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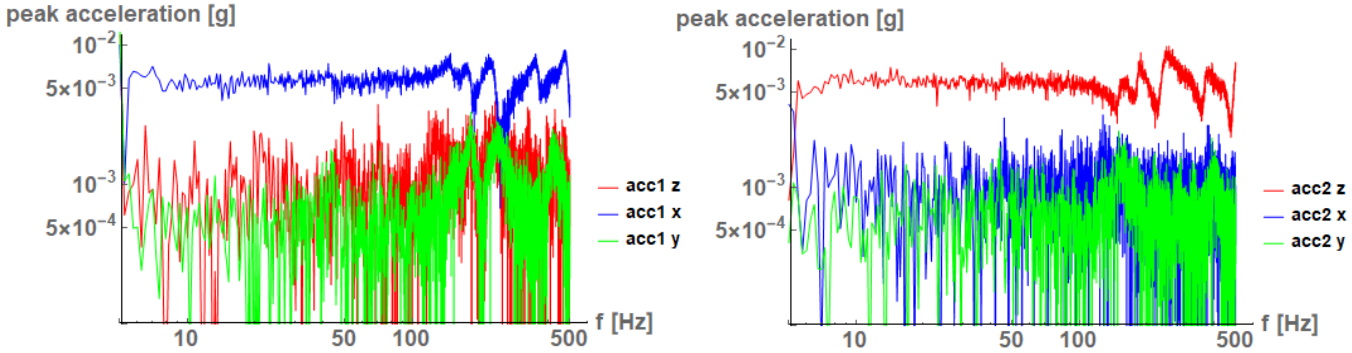
Overview

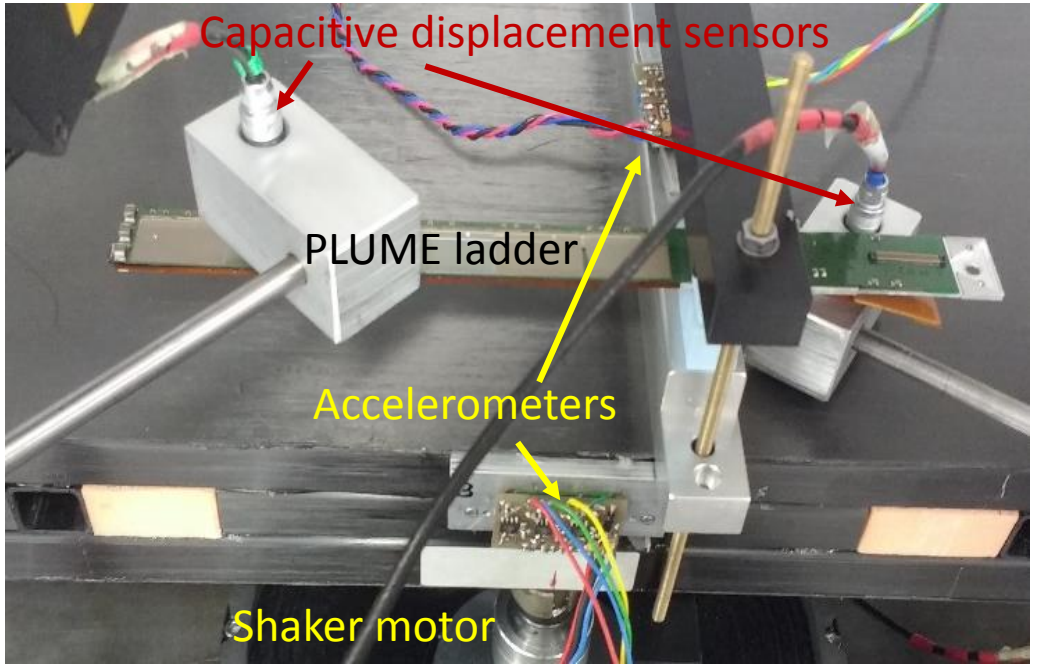
- Various activities are going on in parallel
  - Vibration setup
  - Air-flow setup
  - FSI
  - Climate chamber
  - Photogrammetry
- Activities are a on a spectrum of Oxford core activities (mostly ATLAS) to pure AIDA projects
  - The first external user (Bristol/PLUME) has visited and we continue studies on their devices
- We take the first external user as a milestone and have written the corresponding milestone report (still needs submitting)
- We keep learning a lot about the various technologies
- AIDA-funded post-doc is now gone (since January)
  - Work is done by me and small effort from Armin Reichold)

Vibration setup I

- Frequency scans
  - Vibration amplitude equalized to 5 mg

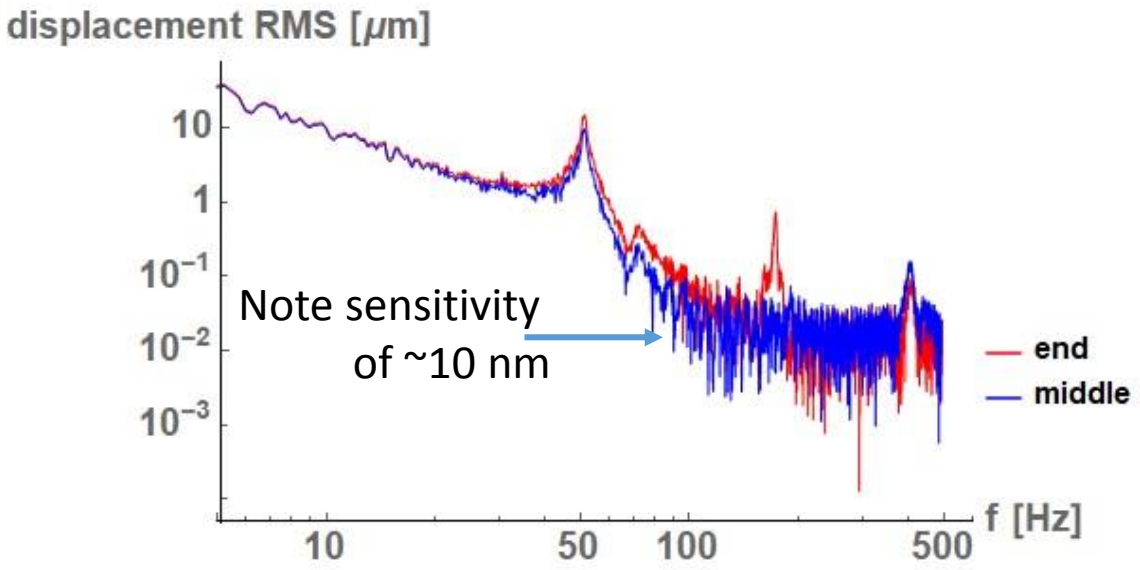


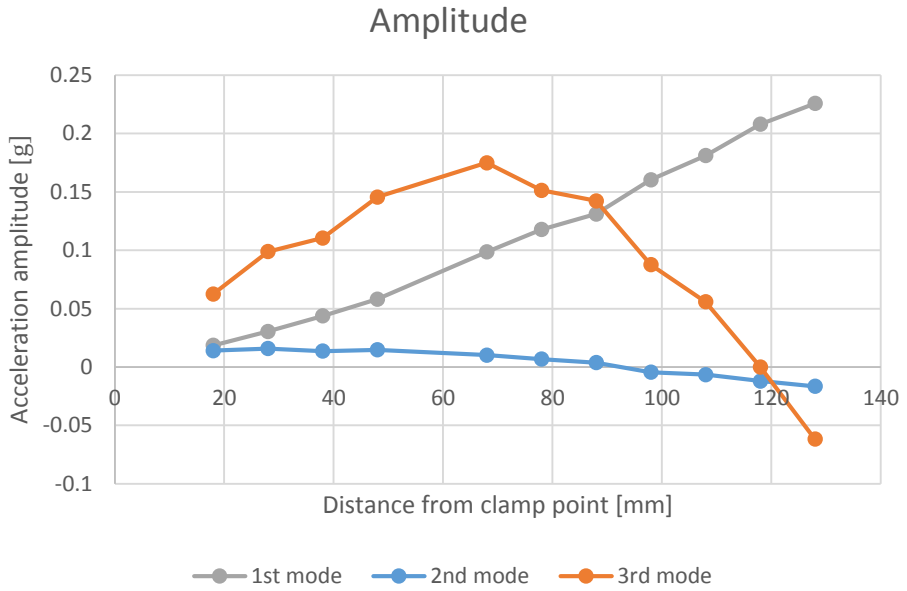
  - Sensitivity of accelerometers marginal
    - New sensor boards with 5× sensitivity being made



- Lots of things learned
  - Played for some time to find optimum geometry and clamping
  - Can't operate more than one capacitive sensor on silicon - low frequency (< 5 Hz) noise introduced
- Mode-shape measurement by moving displacement sensor

Vibration setup II

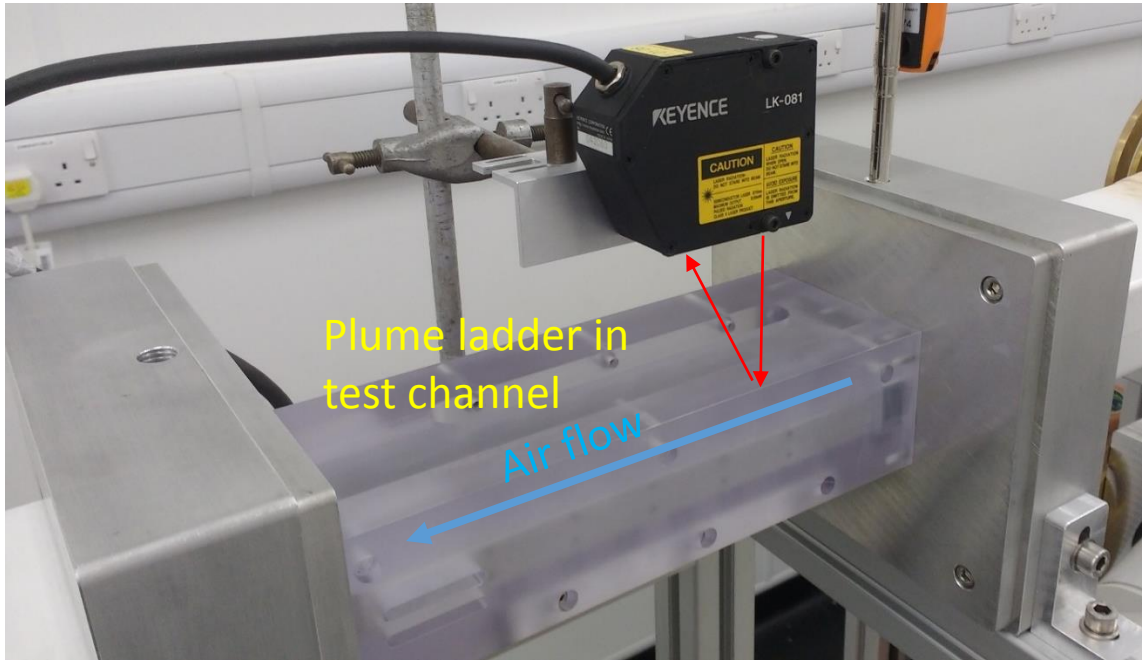




- Three resonance frequencies below 500 Hz identified: 51.5 Hz (Q = 15-16), 170-172 Hz and 407-408 Hz
- Mode shapes for first and second mode as expected for simple fixed-free beam, but third mode not (torsional mode? Non-uniformity along ladder?)
- Future studies:
  - Can we identify torsional modes? (problem: finite size of capacitive sensor vs width of ladder)
  - Response to broad-band excitation

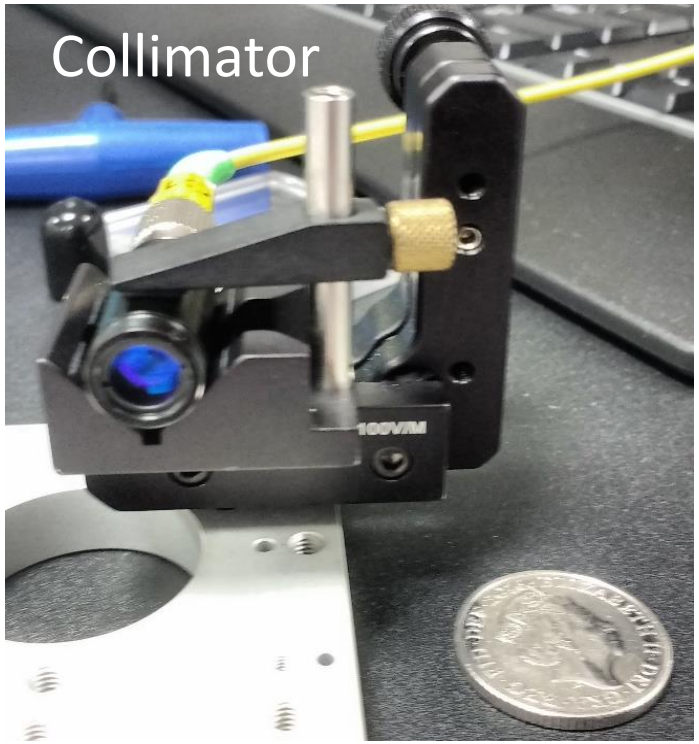
Air flow setup

- This has been the task of the AIDA-funded post-doc
  - He never completed this setup
  - I am now trying to make his designs work – takes time (also, we do not have expertise on air flow systems)
- We have air-flow (no cooling)
  - Without device under test: 6 m/s
  - But dropped by factor 10 when we installed PLUME ladder
    - Optimized air flow: now 3 m/s with ladder in place (although flow at device is probably higher due to restriction of channel)
- Displacement measurements:
  - Abandoned plan to use capacitive sensors (for now): worry that they affect airflow
  - Tried FSI system: could not get reflection from Silicon (transparent in IR) – will mount small mirror
  - For now: use reflected laser sensor: Sensitivity is not great and there are still some noise issues
  - Work ongoing



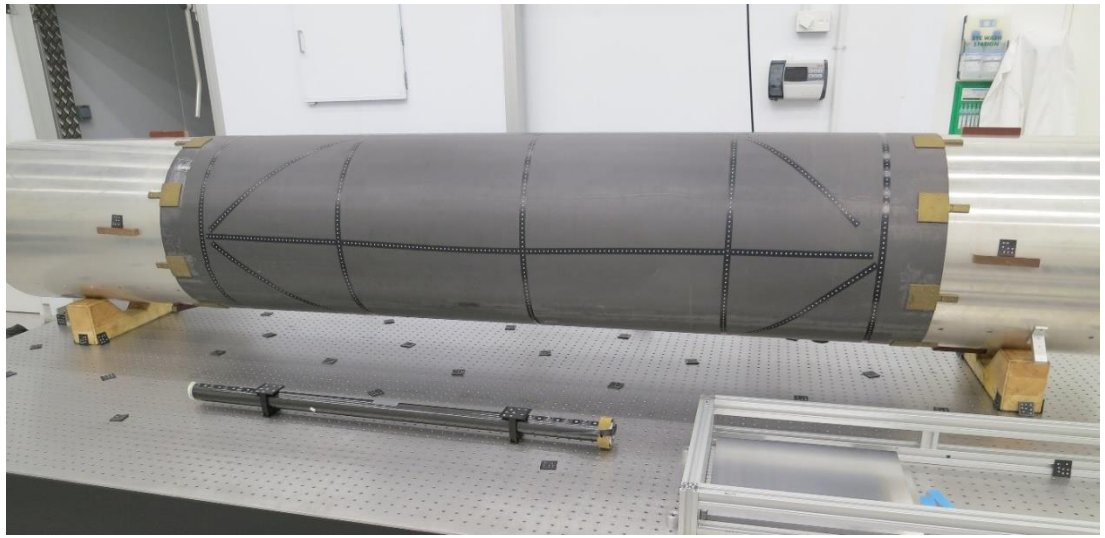
Frequency Scanning Interferometry

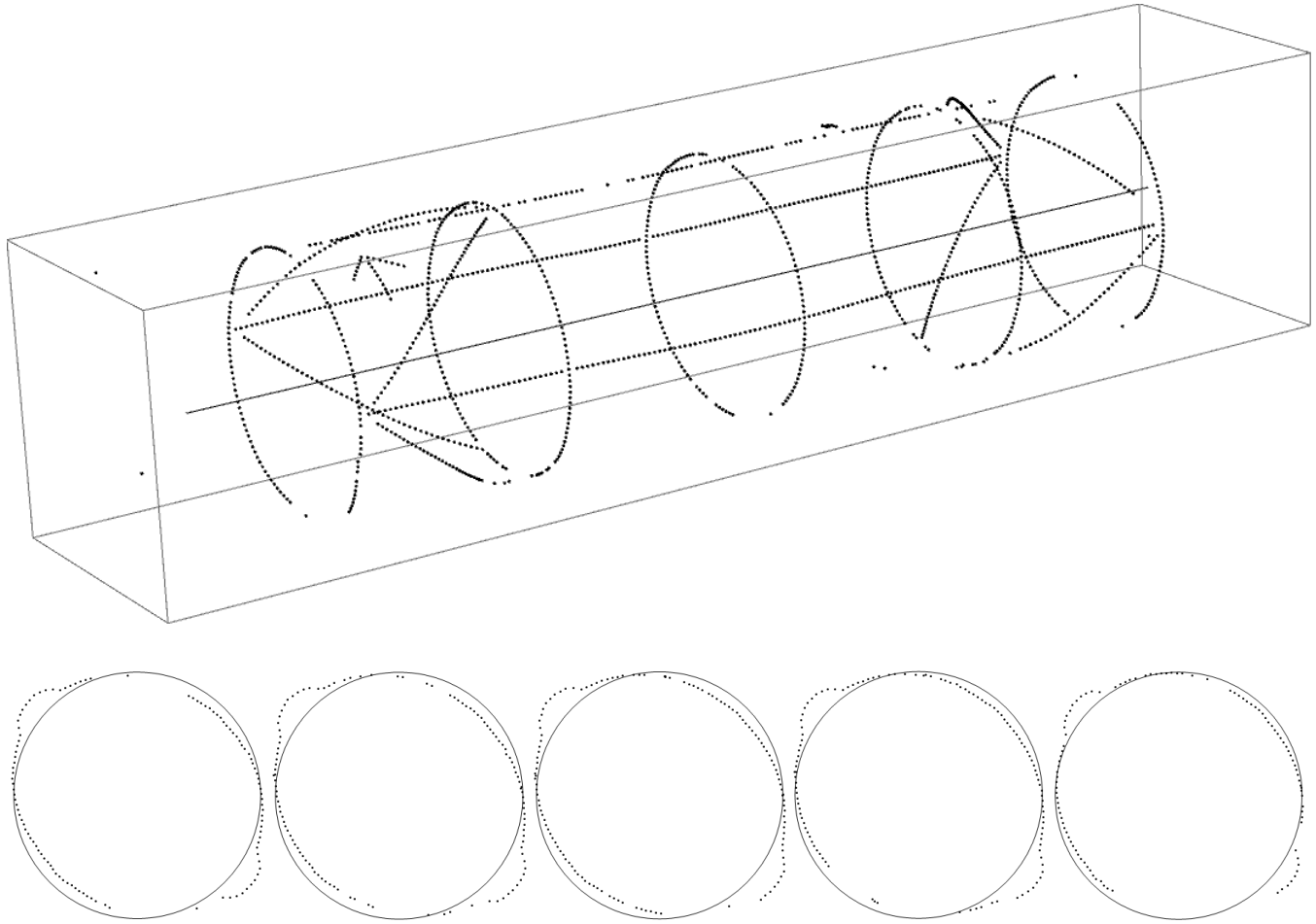
- Interferometric distance measurement technique
  - Allows for absolute distance measurements with an accuracy of 5×10^{-7} m
  - Measures distance from collimator to reflective surface (mirror, retroreflector etc.)
- Originally developed in Oxford for ATLAS ID alignment
  - Now commercialized
- Procured on STFC funds a system with currently four lines-of-sight
  - can easily be upgraded to more channels
- Laser light in the infrared (1550 nm)
- Can measure distances up to 20 m
- We have tested the system on practice setups, but not yet used for real measurements
  - This will change soon:
    - Plan to use it on PLUME ladders (with mirror)
    - To be used on CTE measurements of CF pieces for ATLAS



Other activities - photogrammetry

- Preparation for ATLAS barrel strip construction (but could be made available to other users)
- Survey of large CF cylinders using photogrammetry
- Developing software to track variations and methods to cross-calibrate with other survey techniques





×10 ring deformations from ideal cylinder

Future plans

- Continue work on PLUME ladders
  - In particular airflow
- Collaborate with other users
  - Original plan was to work with Valencia
    - This communication was through the AIDA-funded postdoc and has dried up
    - Would like to start this again and hope that there is still interest
- Further improvements:
  - Vibration setup: improve accelerometers
  - Air flow setup: include cooling
  - Further improvements on infrastructure and sensor systems
- Reviewers have suggested collaboration between T9.2 and T9.3
  - Need to identify relevant questions and corresponding measurements
    - Deformations under pressure and/or temperature variations? Coolant flow?
    - What are the thermal conditions (heat sources and environment)?
    - To make this useful we need a careful definition of the test and best a realistic use case
  - We do have a CO_2 blow-off system at Oxford, other opportunities need to be explored…