

Suspension work at Glasgow

- We are currently investigating stress corrosion of fused silica fibres for both in-air and in-vacuum
- Fibres suspend mass at high stress range (4+GPa) to explore improvement under vacuum
- Building towards ET/CE, prototype fibre designs have been made for 100 kg BHQS scenarios, together with heavier ET-HF scenarios
- Fabricated from 5 mm diameter stock with thermoelastic nulling region of 1200 μm and central thin section of 442 μm (giving 1.6 GPa stress)



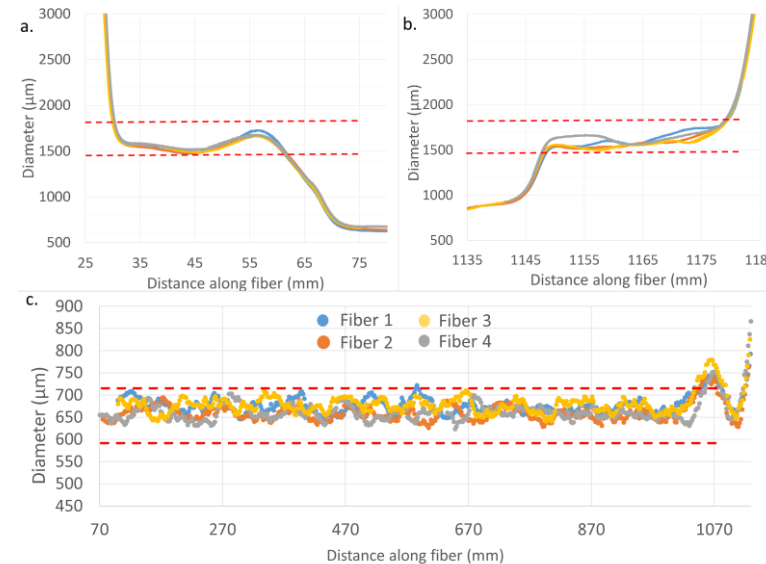
Fibres for heavier suspensions



Humidity controlled fibre storage

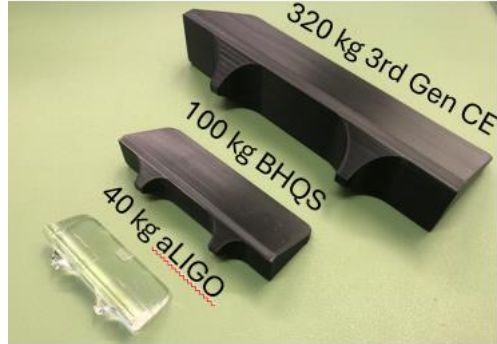


Stress corrosion vacuum setup

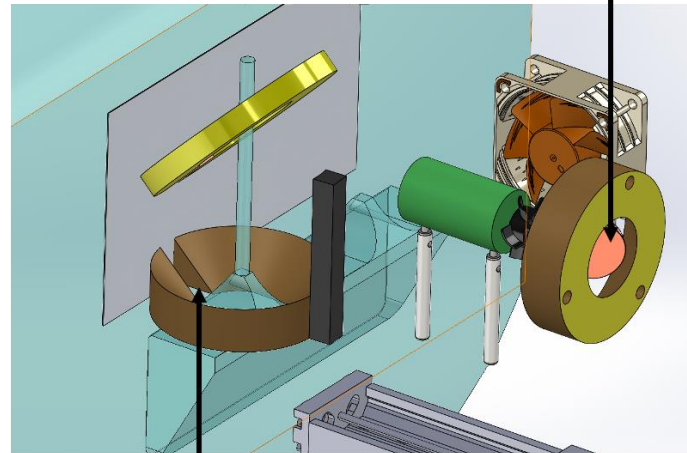


Suspension work at Glasgow

- Multiple single fibre heavy stress single fibre test hangs have been undertaken culminating in a 160 kg 4 fibre hang (5mm stock, 1.2m long, 1.2GPa)
- Prototyping new ear geometries for A# and ET/CE
- Developing in-situ laser welding techniques for thicker stock



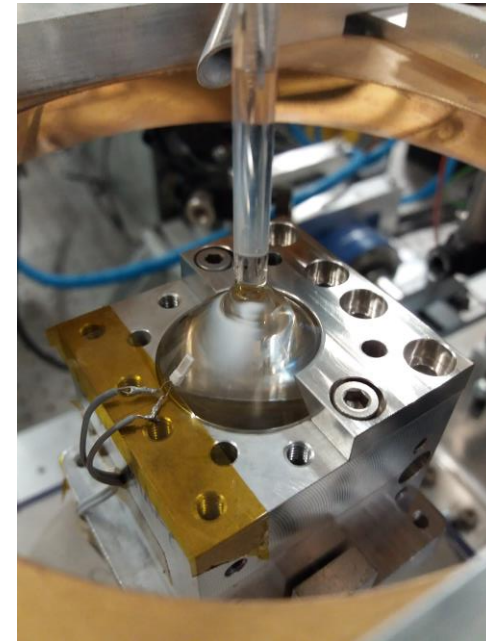
Ear geometries (3-D printed prototypes)



Gap in mirrors to allow for installation around weld area

Rotating mirror to sweep the beam around conical mirror to create cylindrical beam

Mirrors to be operated via motorised stages



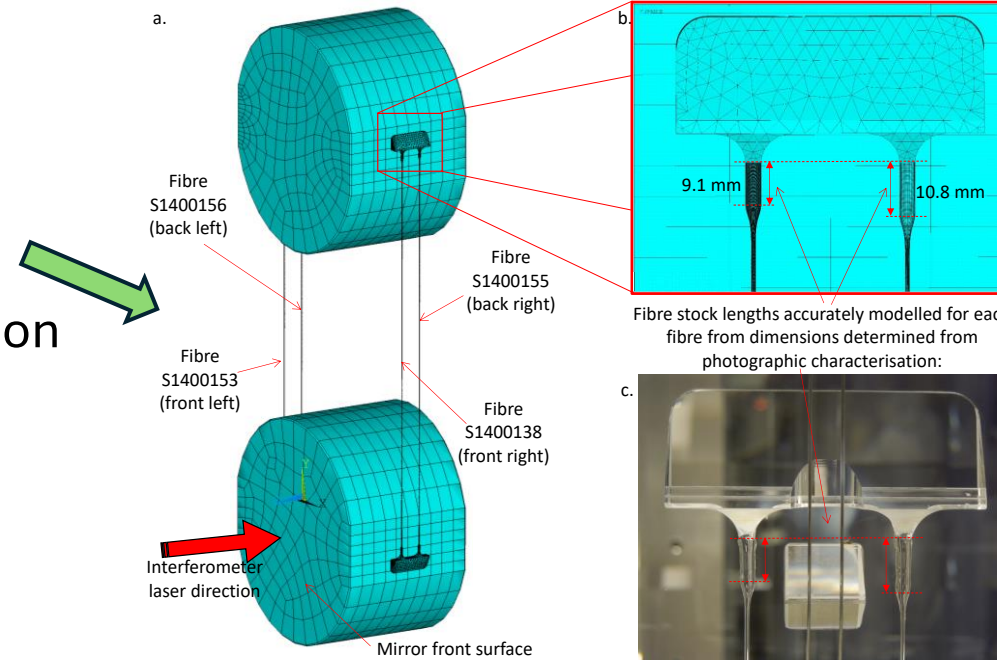
In-situ welding



Heavy suspension hangs

FE Analysis at Glasgow

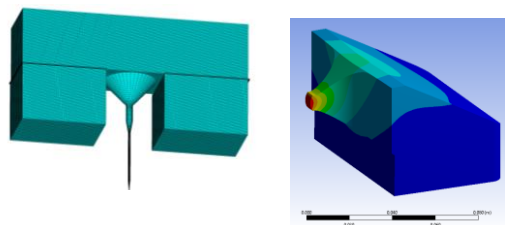
- Existing FEA includes (i) monolithic 4 fibre models with accurate fibre profiles (ii) accurate loss terms and dissipation dilution calculations from energy distributions for Thermal noise evaluation
- Ongoing research areas:
 - Bond thermal noise
 - Violin mode frequencies (mode splitting, modelling of offsets, angles, non-symmetries in fibres)
 - Large geometry ear and anchor models – mechanical stresses



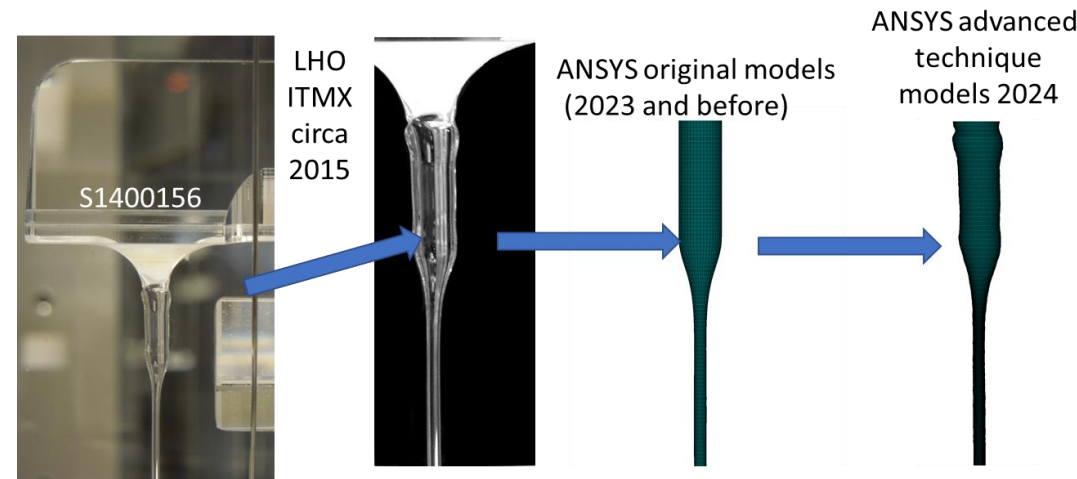
from *Class. Quantum Grav.* 37 (2020) 195019

Future Work

- Under Next-Gen UKRI award we are developing a prototype lower stage suspension (100kg -400kg) to test A#(BHQS/ET/CE) geometries
- 2.7m tall vacuum tank installation 2025



BHQS anchor/ear



A V Cumming et al, *Class. Quantum Grav.* 29 (2012) 035003

L Cunningham et al, *Physics Letters A* Volume 374, Issue 39, (2010), 3993-3998

A V Cumming et al, *Class. Quantum Grav.* 37 (2020) 195019