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2nd Adv. LIGO OSEM Concept Design Review: Interferometric OSEM.

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University of Birmingham.

- **Simplified optical lay-out.**
- **Updated sensitivity measurements.**
- **Tilt sensitivity.**
- **OSEM design.**

- **This presentation is based on report LIGO-T040139-00-K.**

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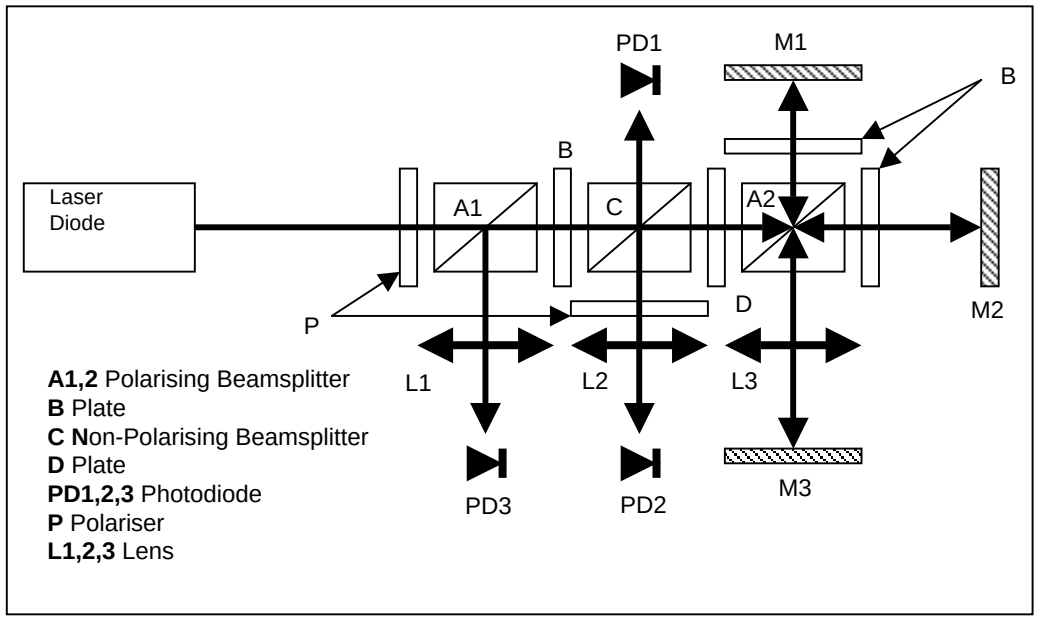
Simplified optical layout



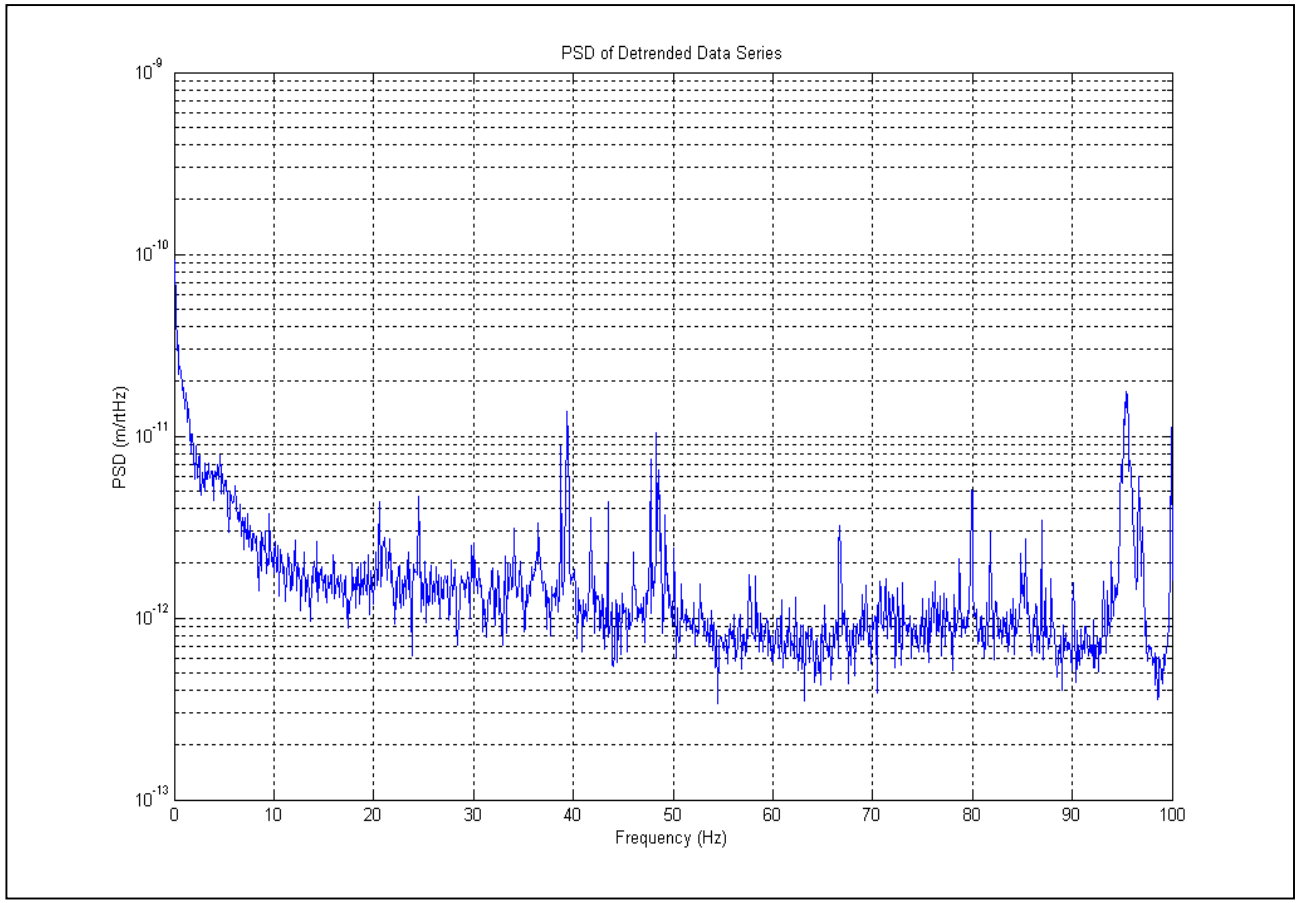
Modified Interferometer Layout

- **'In-line geometry' for ease of manufacture and setting up.**
- **Use crossed polarisers (P,A1) to attenuate input beam to avoid optical feedback.**
- **PD1 is used to monitor laser intensity to centre Lissajous figure.**

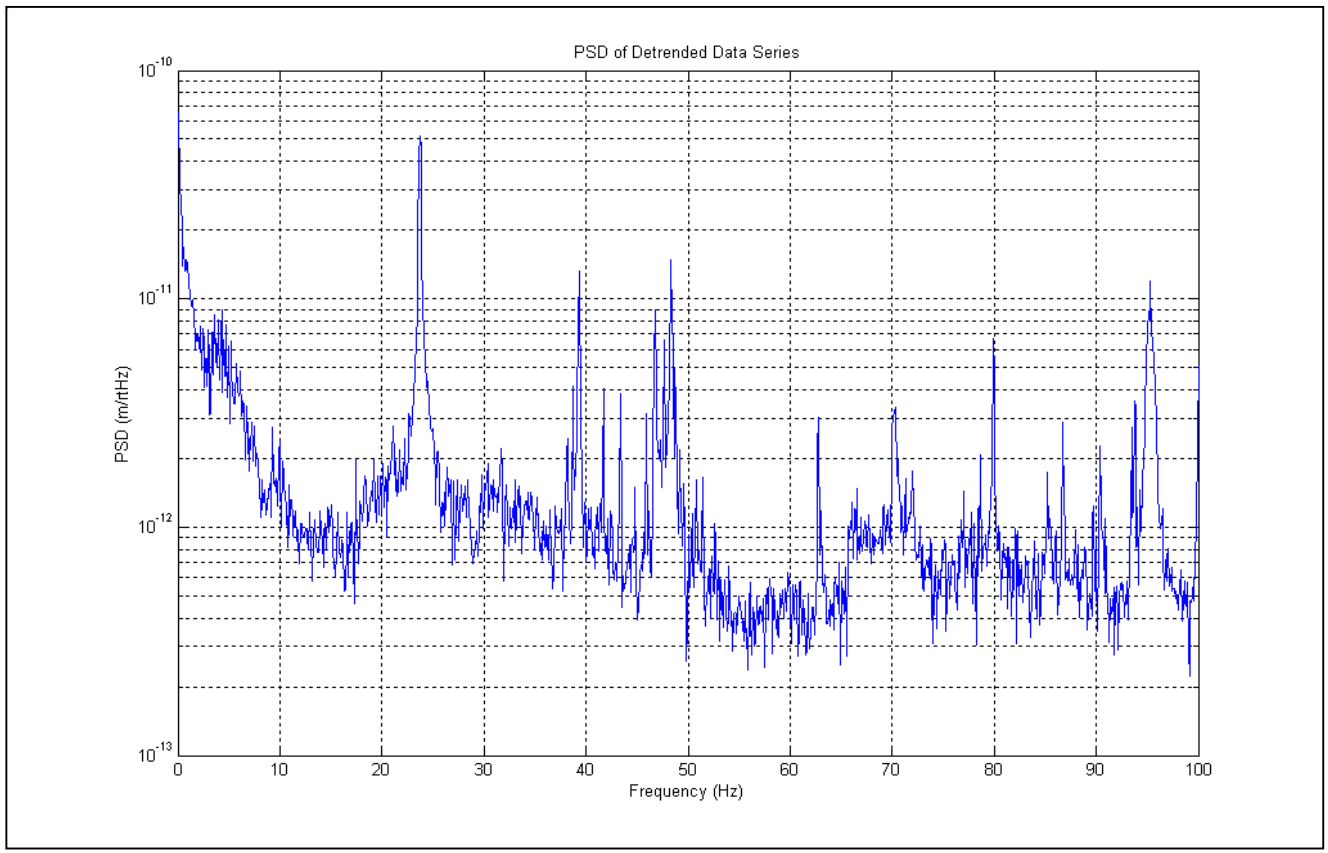
Updated sensitivity measurements

- **Automated measurements over night have shown that the minimum displacement noise at equality of optical paths, previously reported, was largely due to cancellation of environmental noise.**

- **The measurements shown below could still be limited by residual environmental noise. The resolution of the 12bit ADC is ~3.10^{-13}mHz$^{-1/2}$ (50kHz sampling) and shot noise is estimated to be 4.10^{-14}mHz$^{-1/2}$ with interferometer laser power of about 1.4μW.**



Laser diode noise spectrum



He-Ne laser noise Spectrum

Tilt sensitivity

- **Tilt of target mirror, θ, causes optical path of measurement beam to extend by**

$$\delta x \approx 4d\theta^2$$

where *d* is the optical path length between the target mirror and the cat's eye lens.

- **This leads to a reduction is fringe visibility when $\delta x \sim \lambda/2$. In the current optical bench set-up we have *d=18cm* which limits tilt range by *+/-0.6mrad*.**
- **In the OSEM design *d*=20mm giving *+/-2mrad*.**

OSEM prototype design

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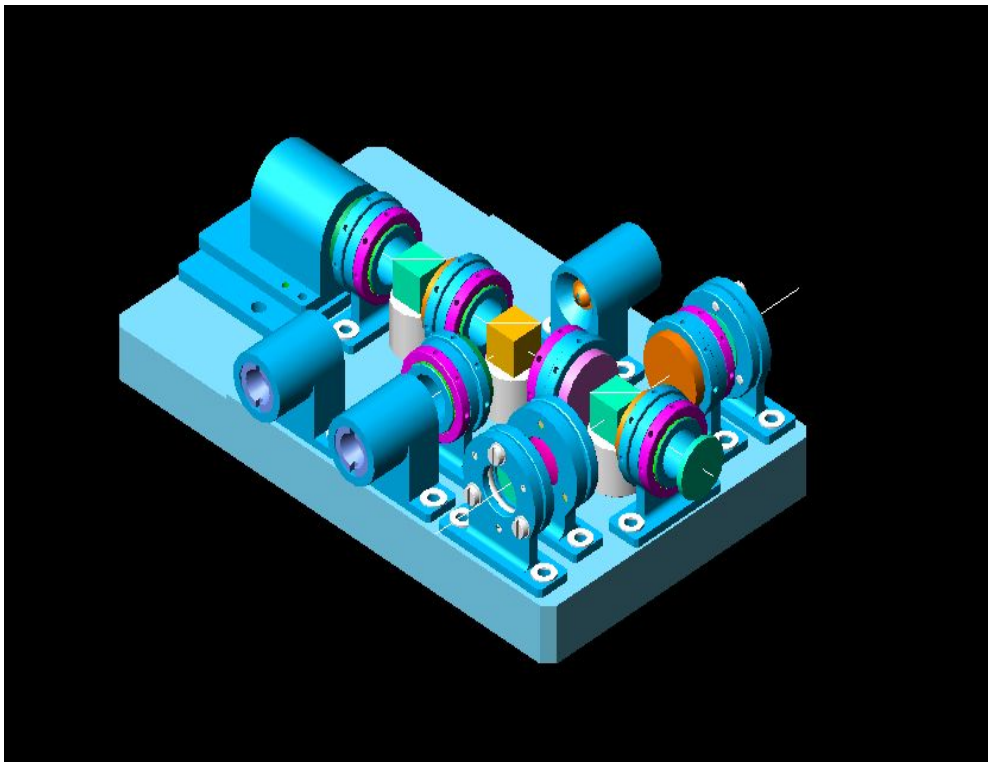

Prototype Development Interferometer Design

- **foot-print to fit 40x70mm requirement of Advanced LIGO**

OSEM design

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