Suppressing stimulated Brillouin scattering and speckle effects by adjusting the seed laser wavefront in a high-power multi-mode fibre amplifier system

Ori Henderson-Sapir [a], Shuen Wei [a], Linh V. Nguyen [a, b], Stephen C. Warren-Smith [a, b], Erik Schartner [a], Heike Ebendorff-Heidepriem [a] and David Ottaway [a]

[a] *Institute for Photonics and Advanced Sensing and School of Physical Sciences, University of Adelaide, Adelaide, SA 5005, Australia*

[b] *Future Industries Institute, University of South Australia, Mawson Lakes, SA 5095, Australia*

High power, single-mode fibre amplifiers maximum power levels have stopped increasing in the last decade due to limitation imposed by non-linear effects, including stimulated Brillouin scattering (SBS) and transverse mode instabilities (TMI) [1]. In previous work [2], we successfully demonstrated the potential of using multi-mode (MM) fibres concurrently with wavefront shaping (WFS) by applying a spatial-light modulator (SLM) to reduce the onset of SBS at high power in single mode and few mode passive fibres.

In this work we continue our investigation of mitigating SBS using a seeded amplifier configuration, where the single-mode seed beam is modified by reflecting off an SLM creating a modified pattern. This patternis then launched into an active (Er/Yb co-doped, Nufern FUD-4197) fibre under 915 nm pumping condition.

The experimental setup is presented in Fig. 1, where the previously passive MM fibre was replaced with an active fibre and a high-power, multi-mode, 915nm fibre coupled diode is used to cladding-pump the active fibre in a counter-propagating direction. The single mode seed with modified pattern is then amplified in a master-oscillator power amplifier configuration.

Theoretical and experimental results using this configuration will be presented.

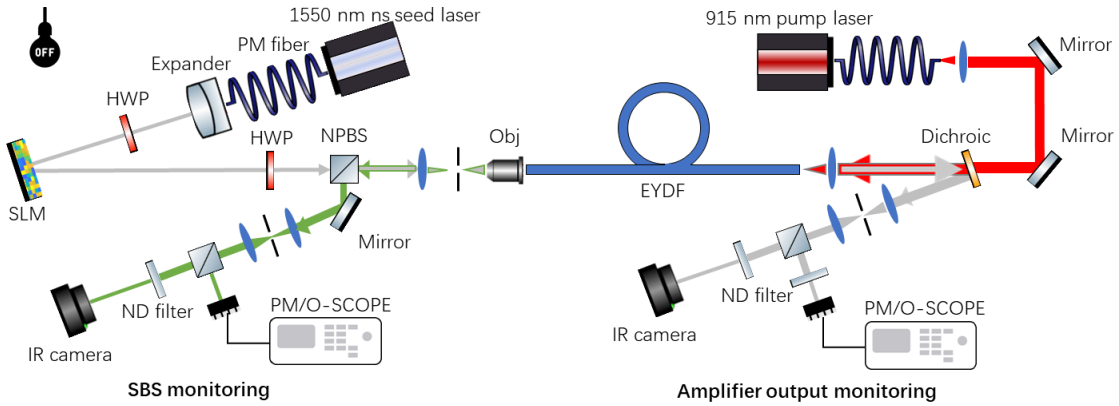

Fig. 1. Schematic setup of the SBS-suppressing, WFS seeded, high-power MM amplifier system. PM fiber: polarization-maintaining fibre, HWP: half-wave plate, SLM: spatial light modulator, NPBS: non-polarizing beam splitter, Obj: objective lens, EYDF: erbium ytterbium co-doped fibre, PM: power meter, O-SCOPE: Oscilloscope.

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