Results

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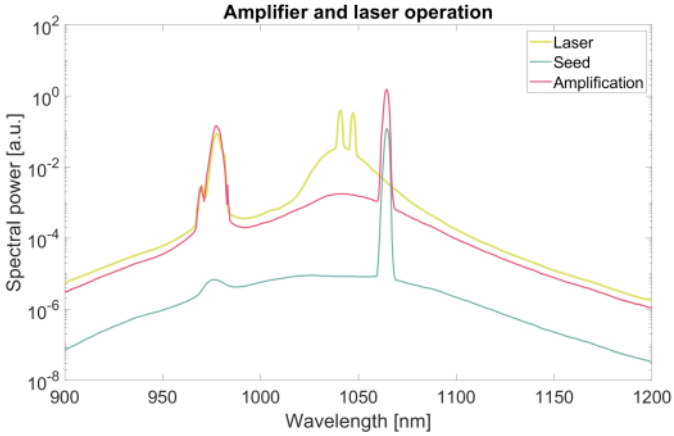
Amplifier setup

The fiber was cladding pumped at 976nm and seeded at 1060nm. The coupling was done using a free space setup and the wavelengths were combined with a dichroic mirror (DMSP1000, Thorlabs).
The figure below shows the signal spectrum after the fiber from seed alone, the amplified signal, as well as laser lines around 1040nm and 1047nm, that could be achieved without the seed and only the weak cavity formed by the Fresnel reflection at the fiber ends.



The seed and pump power were 740mW and 17.39W respectively, which resulted in 2.644W in the signal range and a gain of 5.53dB (on/off 11.57dB). For smaller signals, the gain around 1060nm went up to 15dB although the ASE made up the biggest part off the output power. Also there was a substantial amount of the pump power left at the fiber end. These could be addressed by optimizing the fiber length for the intended operation regime.

Spectroscopy

A fluorescence and a absorption spectrum were obtained. The fluorescence was analysed by pumping at 976nm and measuring the spectrum given off to the sides by placing the fiber in an integrating sphere and connecting it by fiber to a spectrum analyser.
By using the Füchtbauer-Ladenburg relationship and the measured fluorescence lifetime of 1.2ms the emission cross section for the sample was calculated. The peak of the emission cross section was assumed to be of the same value as the maximum of the absorption cross section. This was used to scale the absorption spectrum and to translate it to the absorption cross section.