NANYANG TECHNOLOGICAL UNIVERSITY
School of Electrical & Electronic Engineering

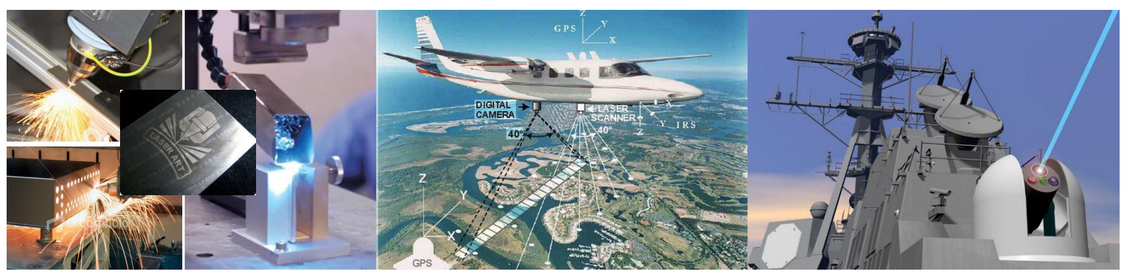
OPTIMUS PHOTONICS
OPTIMUS – Centre for OptoElectronics and Biophotonics

High Power Fiber Lasers

Introduction

Fiber lasers have gained extensive attention over the past decades, due to their high efficiency, excellent beam quality, good thermal management, long lifetime and especially, good power scaling ability. High power fiber lasers have a wide range of potential application in material processing, remote sensing and military applications.

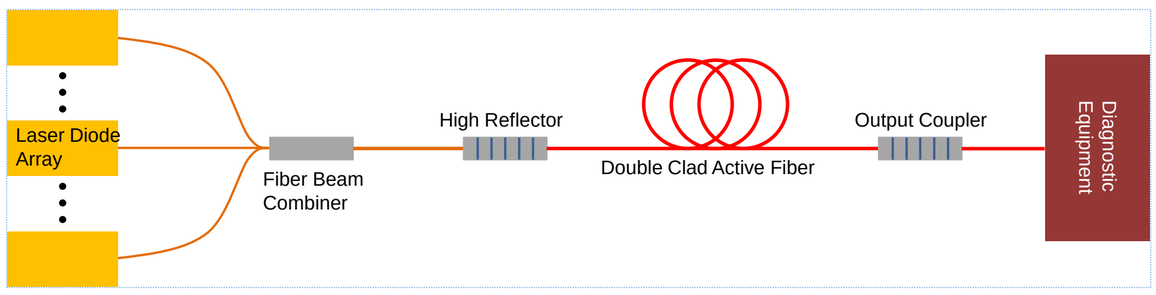
The main objective of this project is to develop and build a robust and versatile CW fiber laser with high brightness and high power.

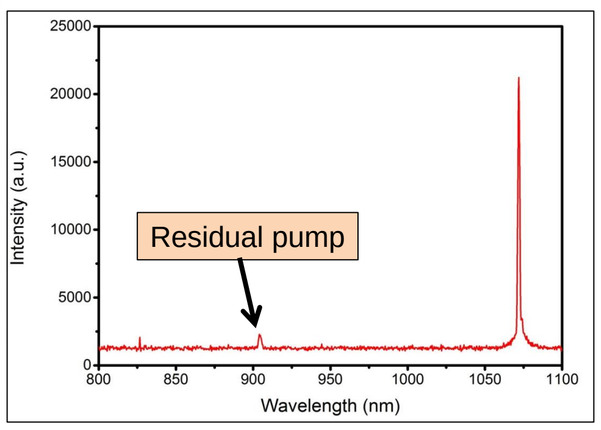


- Material processing
- Remote sensing
- Military application

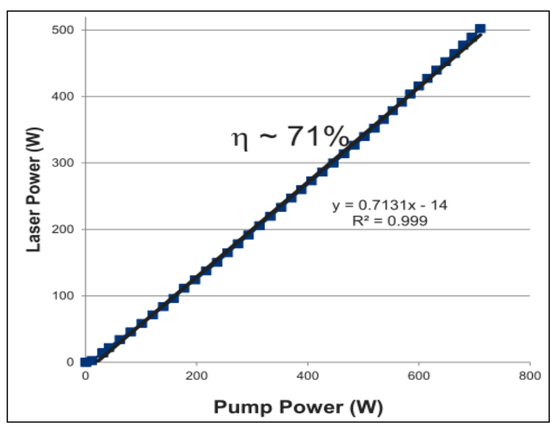
Experimental setup & results

High Power CW Fiber Laser

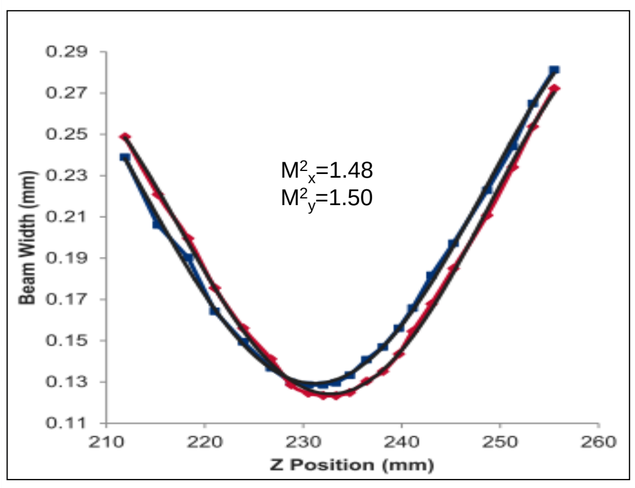




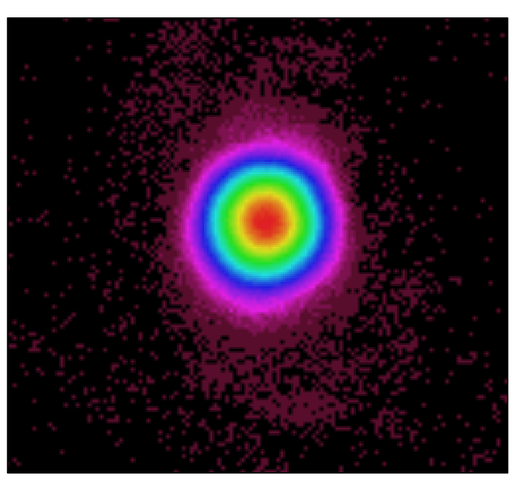
Output Spectrum



Efficiency curve



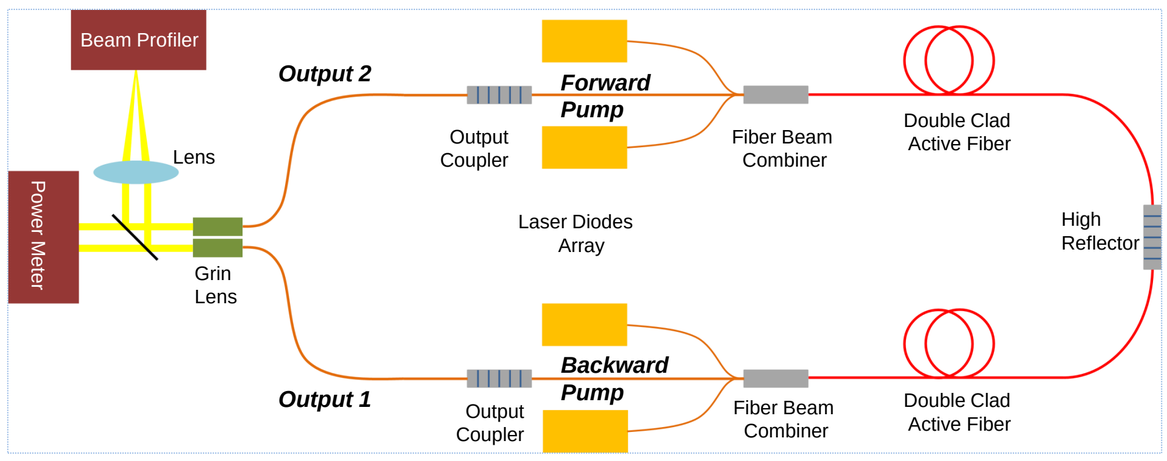
M^2 measurement

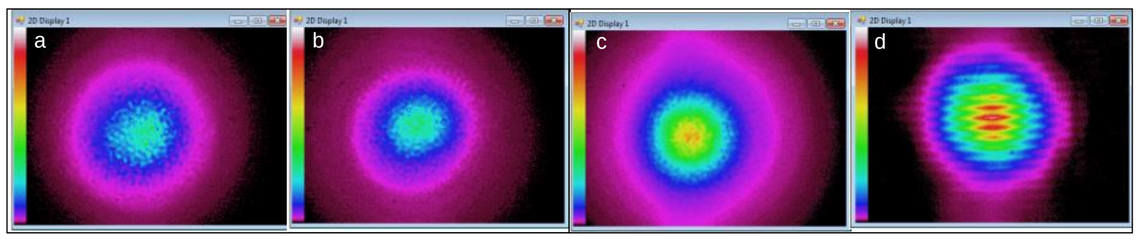


Far field image of output laser beam

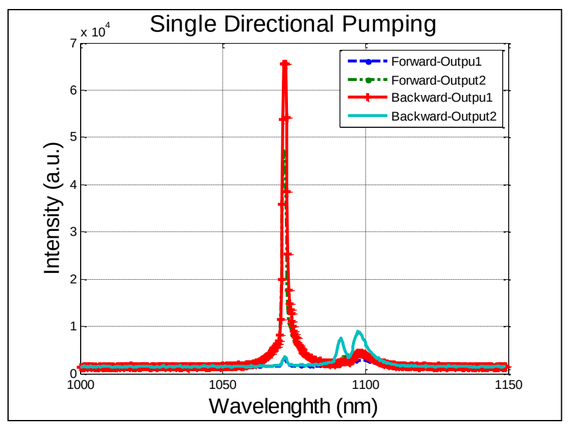
Conclusion:
We obtained laser output power of about 500 W at 1070 nm with optical-optical slope efficiency of ~ 71 %. The beam quality of the output beam is near diffracted limited with M^2_x ~ 1.48 and M^2_y ~ 1.50.

Coherent Beam Combination (CBC)

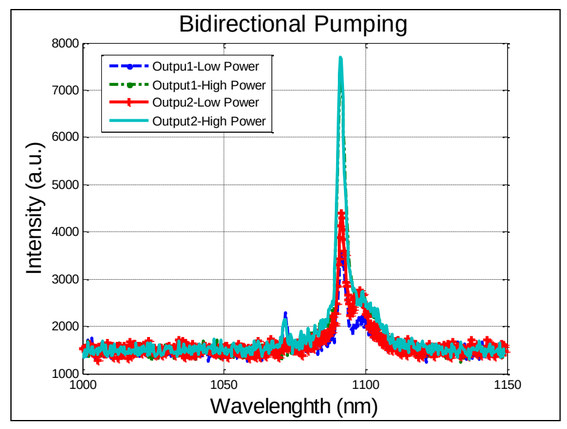




Beam profile of individual and combined laser output. a). Laser 1; b). Laser 2; c). Combined output with HR=99%; d). Combined output with HR=80%



Single-directional pumping, strong and clean 1070 nm is observed at the backward output while small 1090 nm at the forward output



Bi-directional pumping, strong 1090 nm is observed

Conclusion:
Coherent beam combination (CBC) was achieved when 80% HR FBG was used to form the coupled cavity. The combining efficiency is as good as 90%. Switching of output wavelength between 1070 nm and 1090 nm was also obtained by controlling the direction and power of the pump sources.

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