

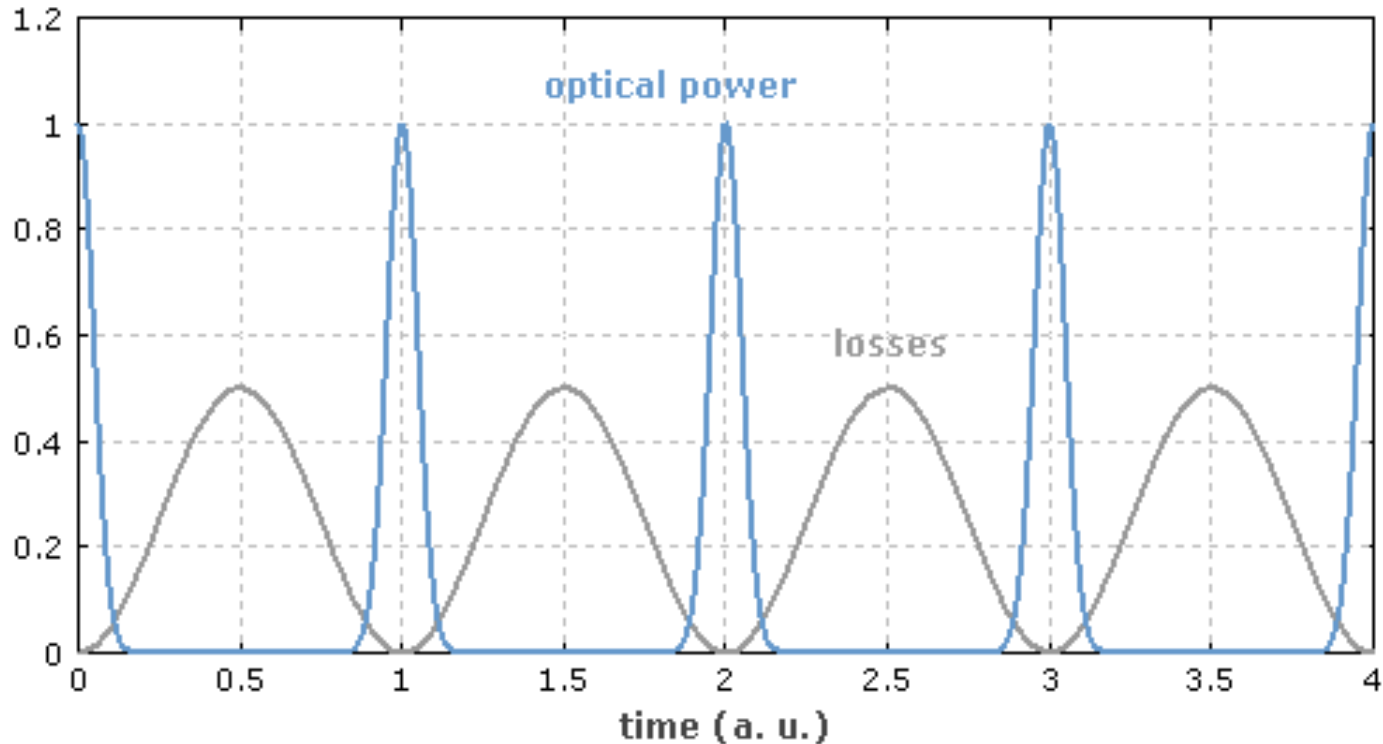
Discrete excitation of mode pulses using a diode-pumped solid-state digital laser

Sandile Ngcobo, Teboho Bell



our future through science

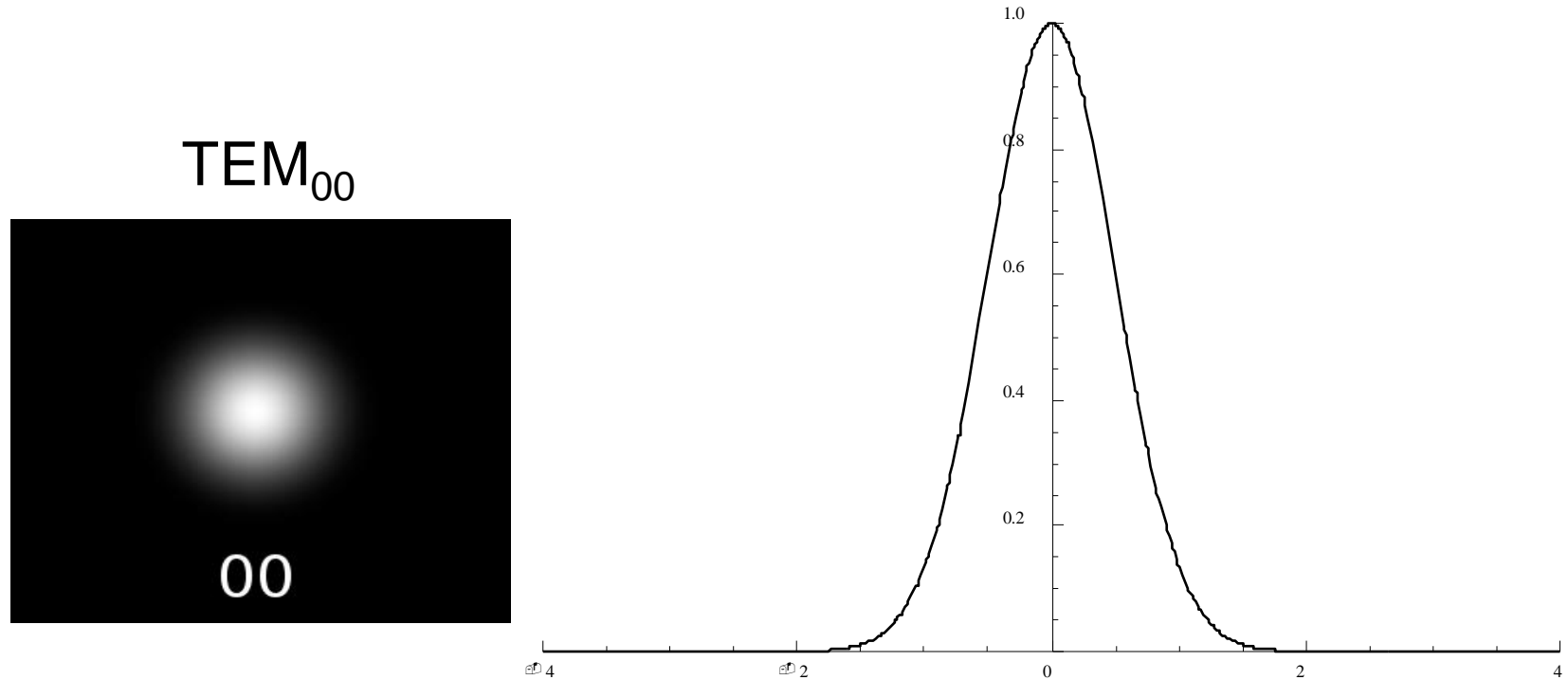
General method of generating laser pulses is by modulating the resonator losses



Examples:

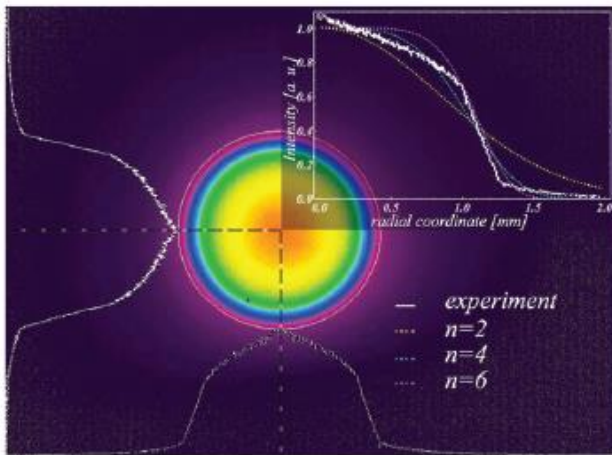
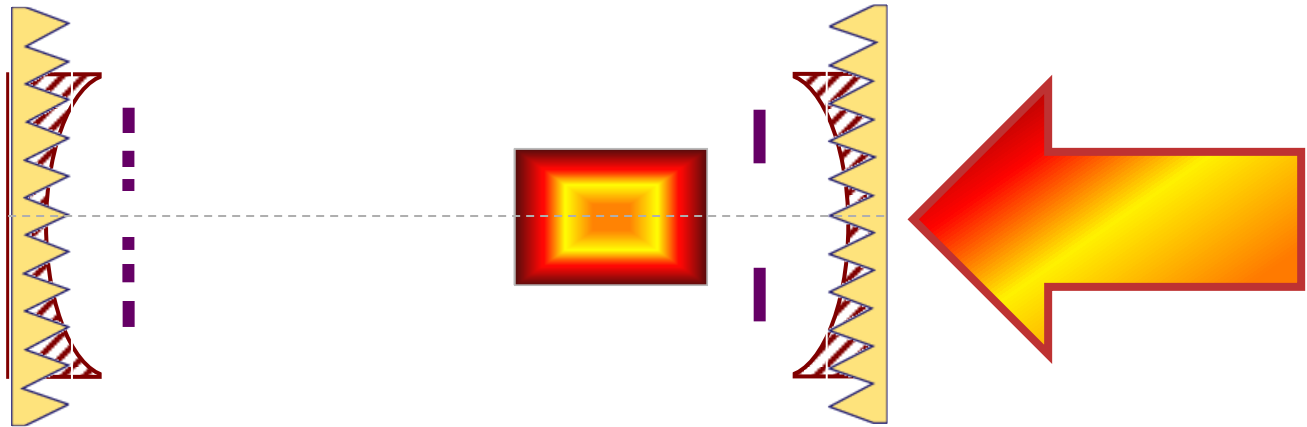
- Q- switched lasers
- Active Mode locked lasers
- Passive Mode locked lasers

General laser beam pulse profile of a pulsed lasers

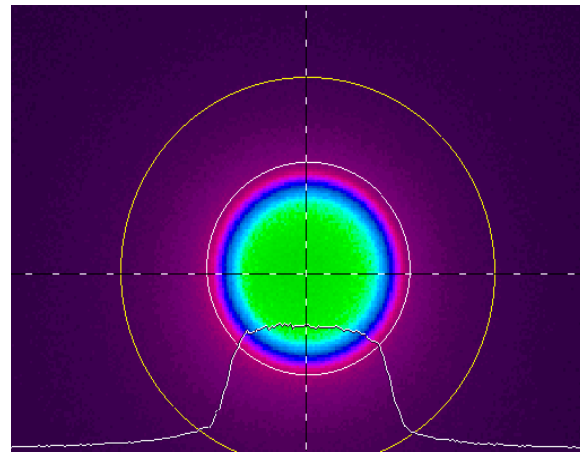


Note: No laser has been developed that can generate various controlled laser mode pulses.

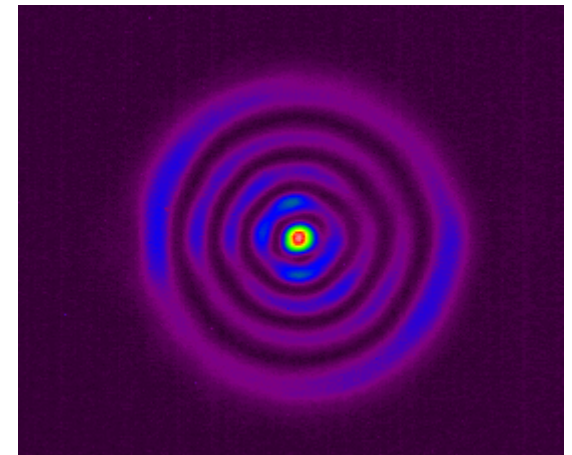
There are many approaches to controlling the mode inside a laser ...



Optics Letters **37**, 49 (2012)
J. Mod. Optics **59**(3), 241 (2012)
Optics. Commun. **284**, 5475 (2011)

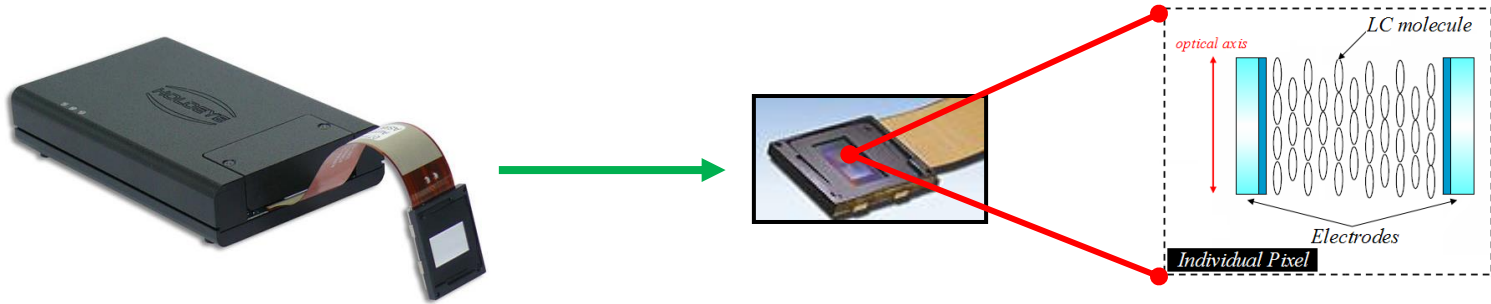


Optics Express **21**(9), 10706 (2013)
Optics Commun. **285**, 5268 (2012)
Optics Express **18**(5), 4701 (2010)
Optics Letters **34**(19), 2991 (2009)

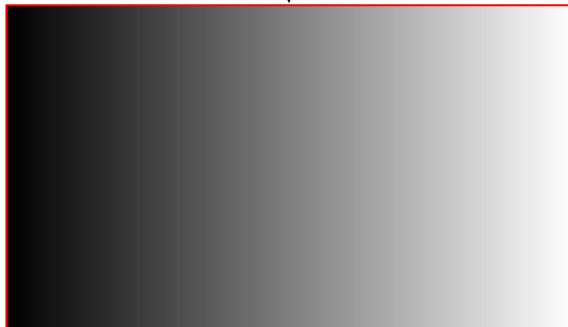
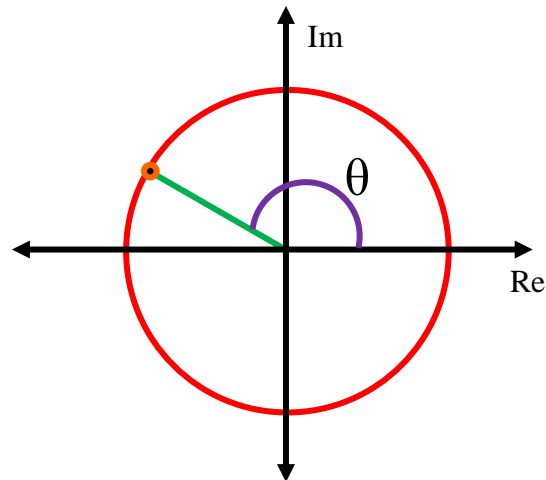


Applied Optics **52**(10), 2093 (2013)
New J. Phys. **14**, 053021 (2012)
Optics Express **20**(25), 27866 (2012)
Appl. Phys. B **106**, 683 (2012)

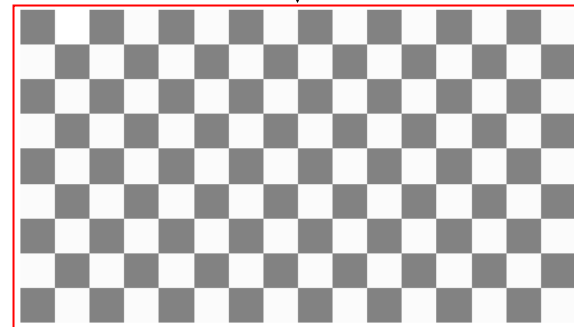
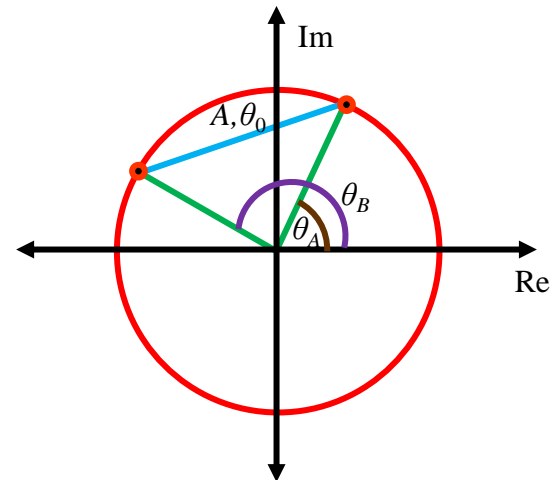
Spatial light modulator (SLM) beam shaping



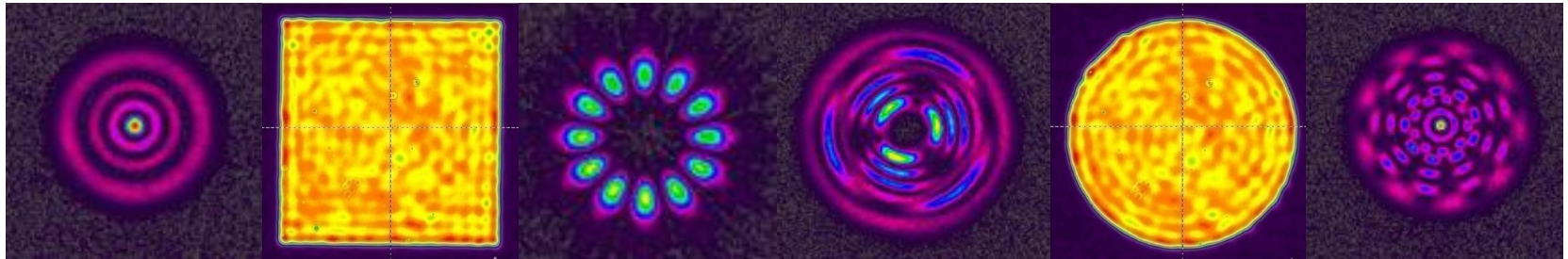
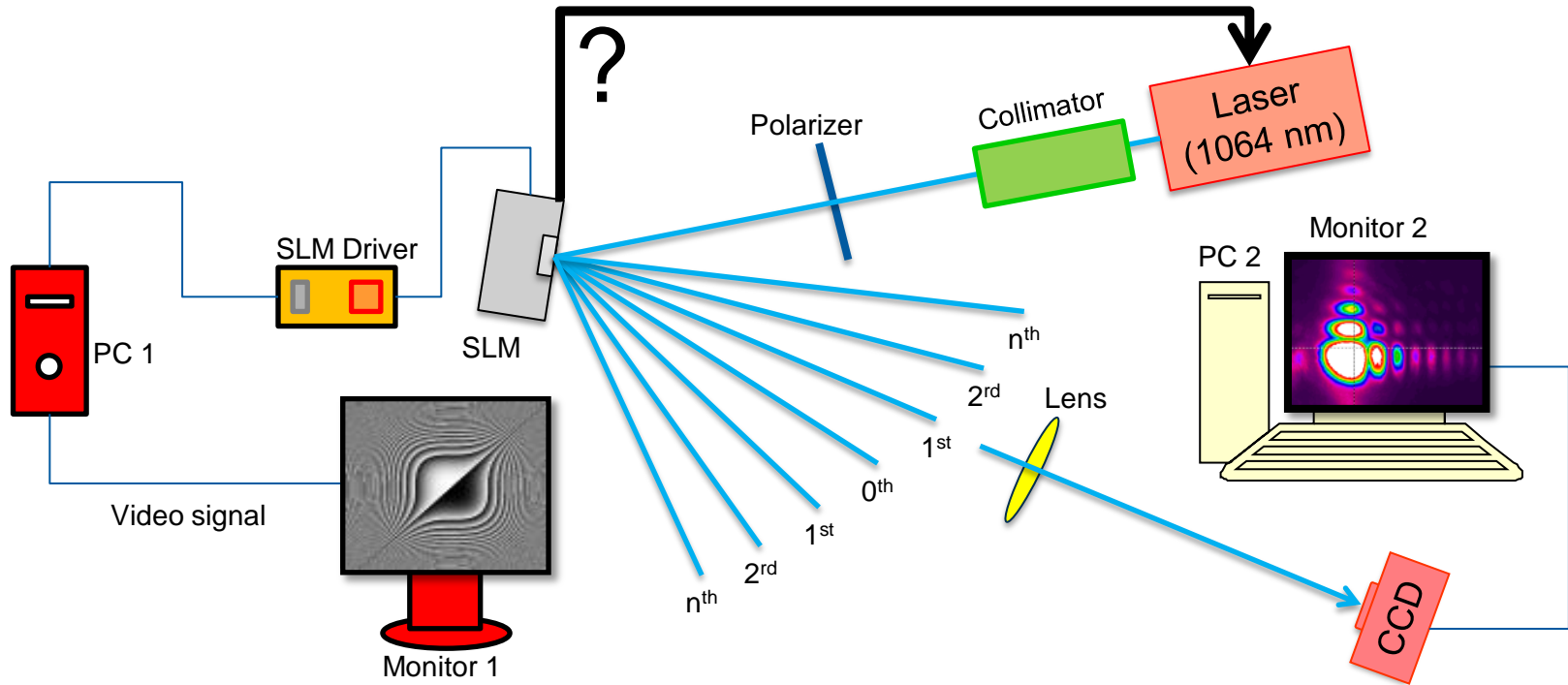
❖ Phase beam shaping:



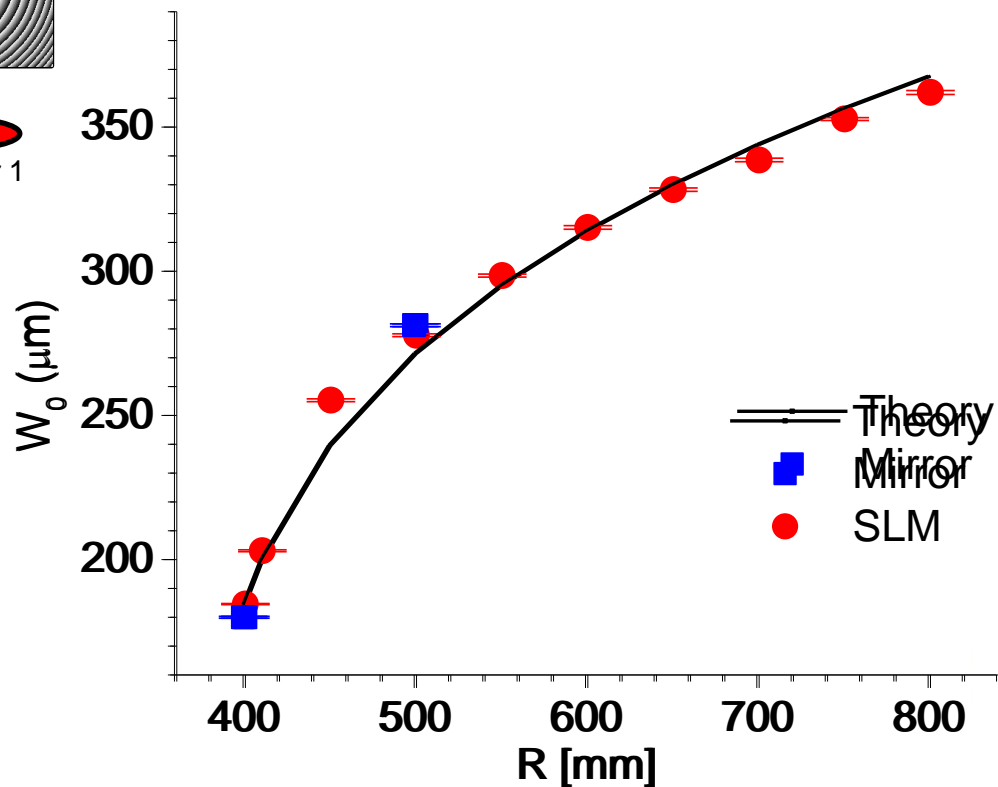
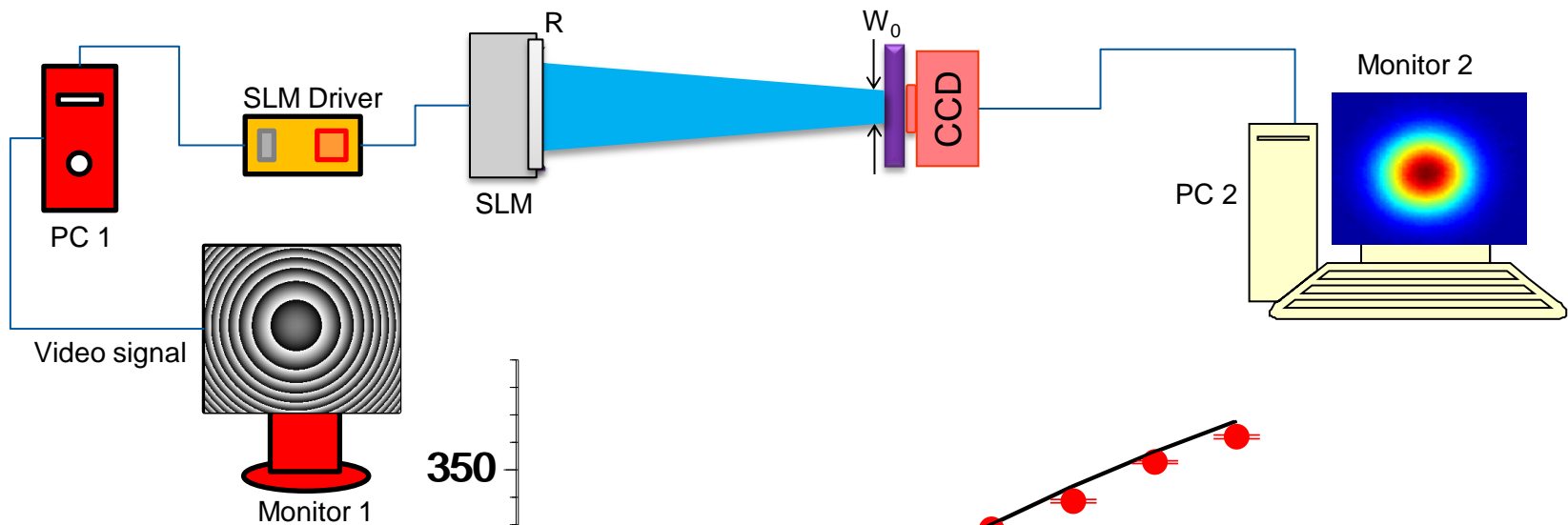
❖ Amplitude beam shaping:



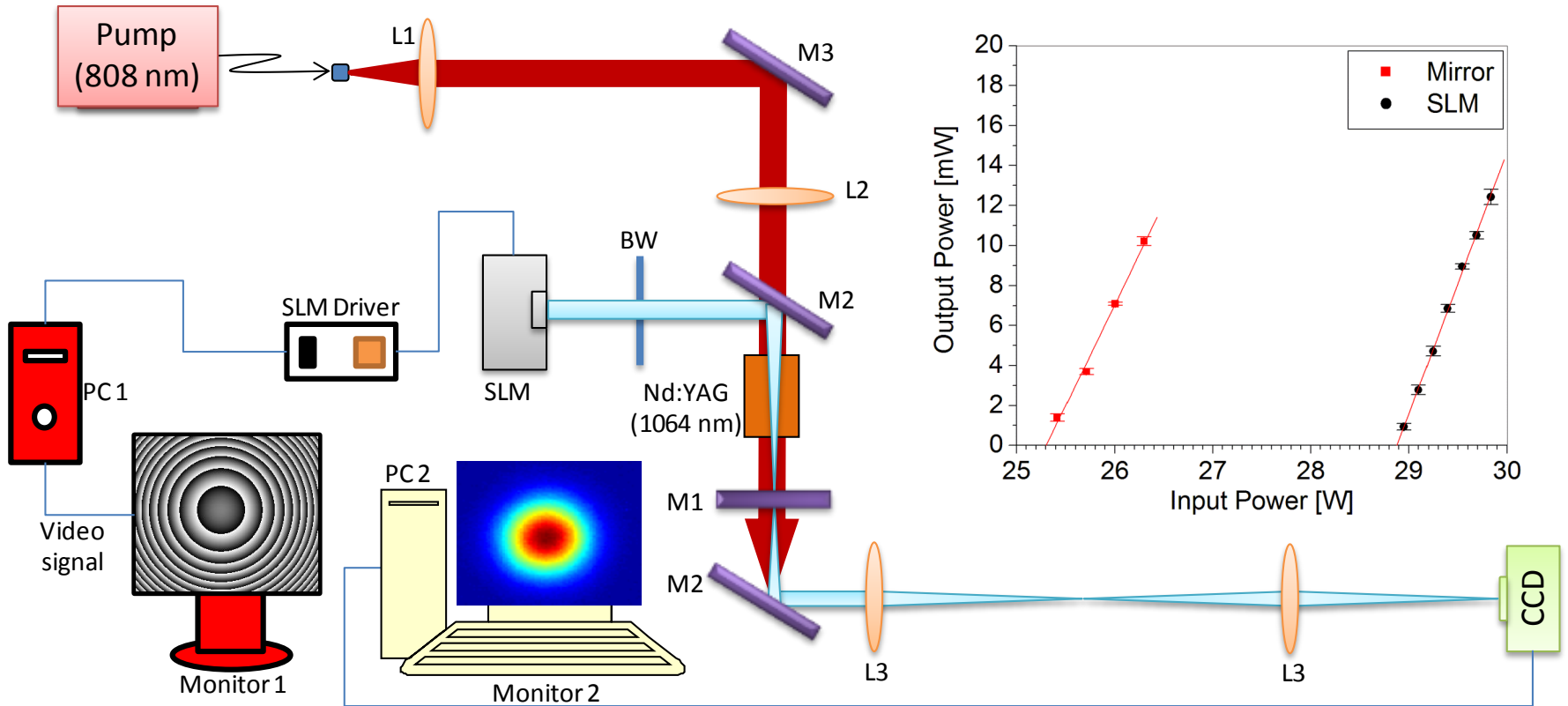
Can we do all of this inside the beam “digital laser”?



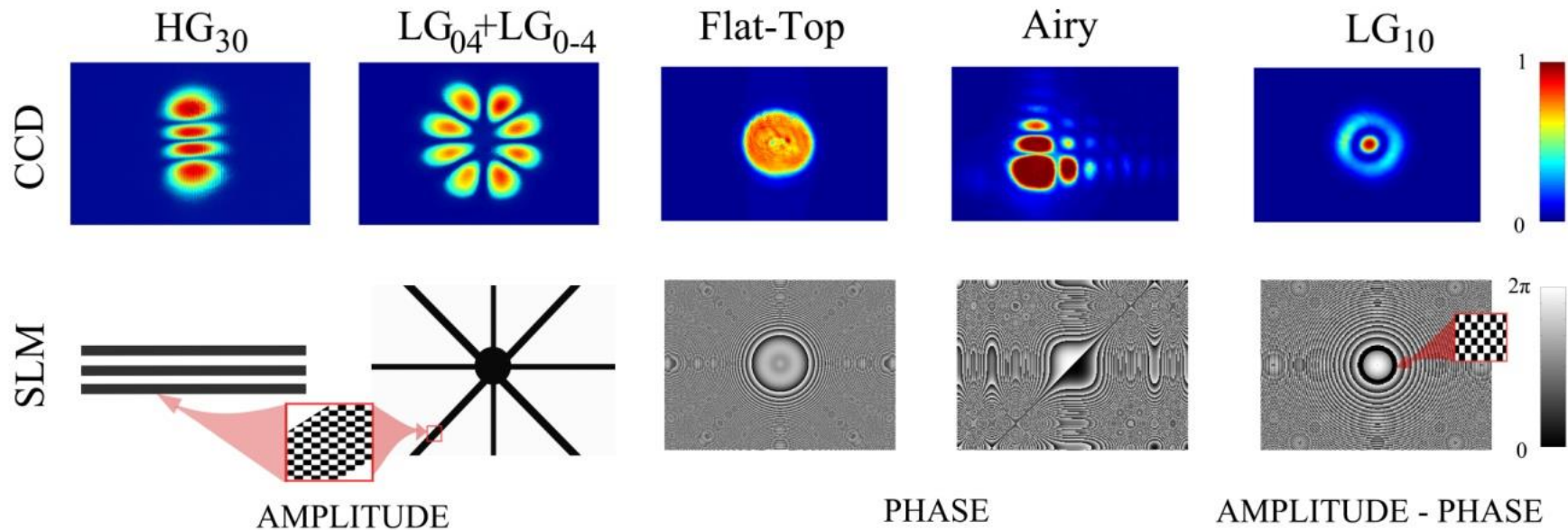
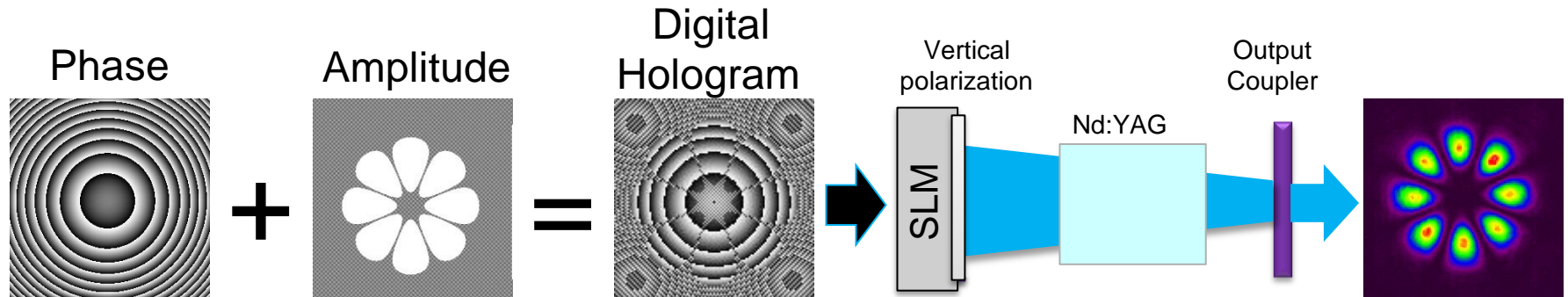
Conversion of a flat cavity to a spherical cavity

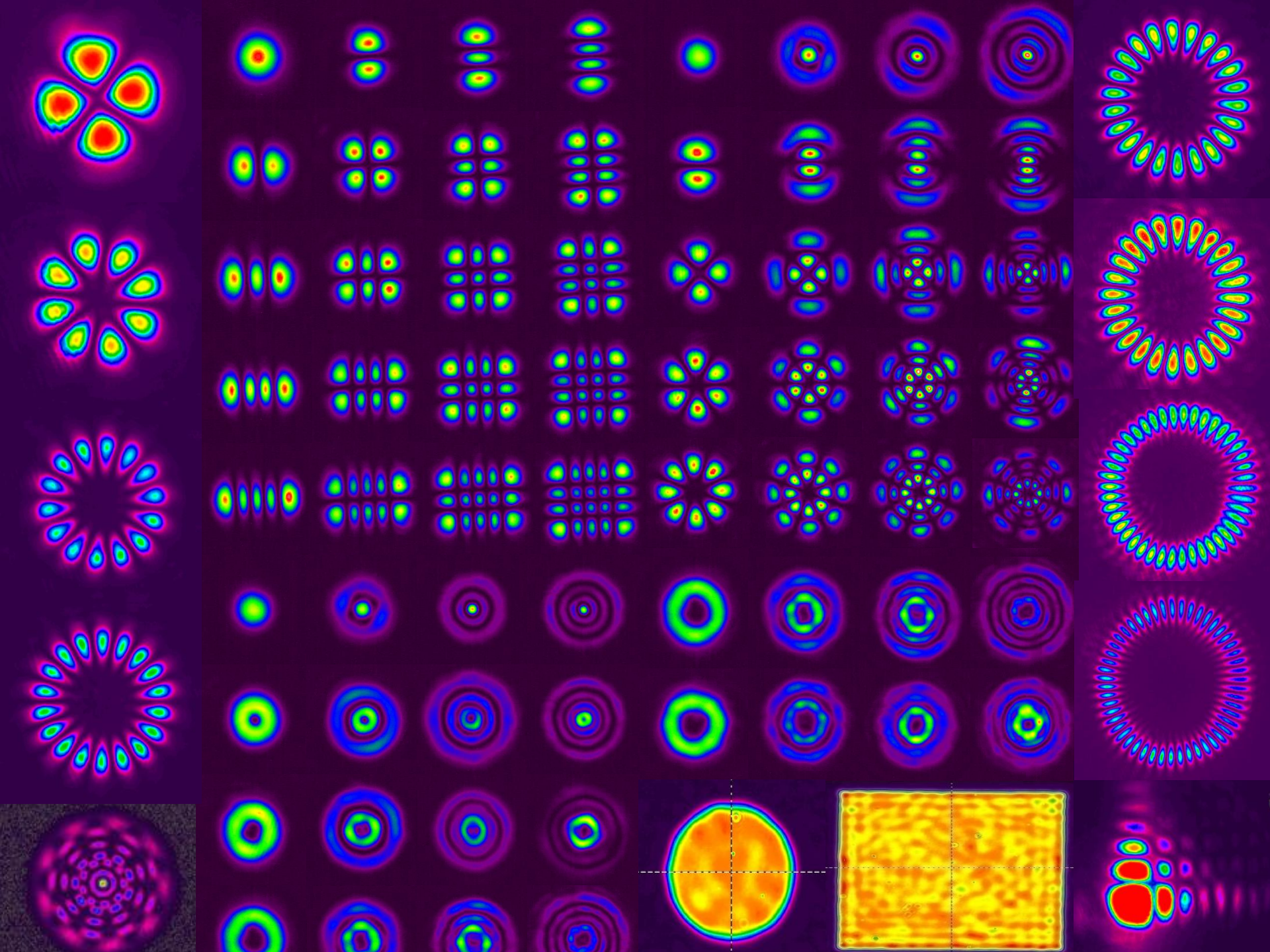


Experimental setup used to test the laser

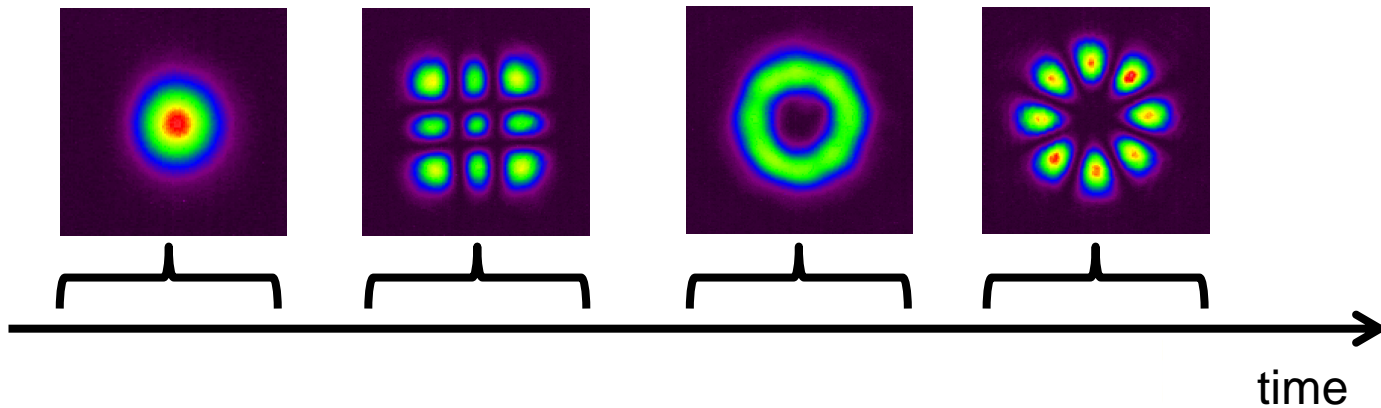
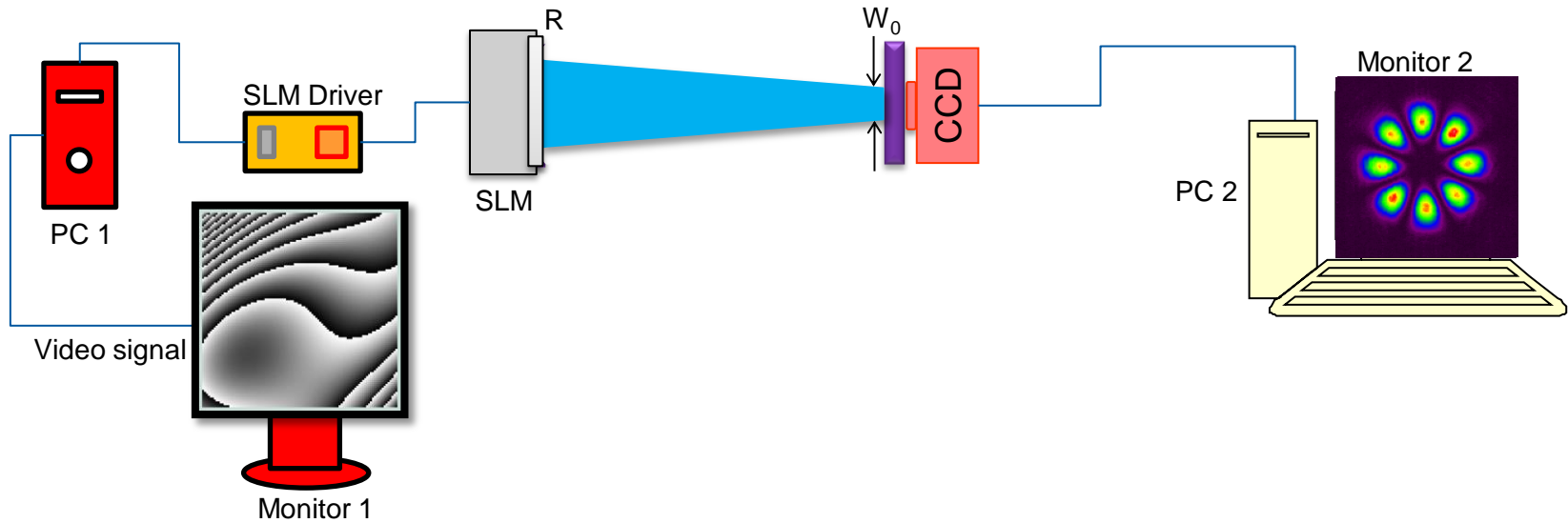


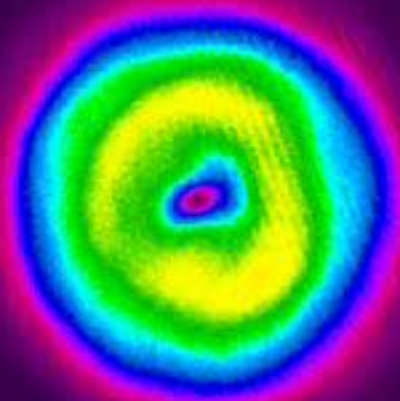
On demand customised laser mode



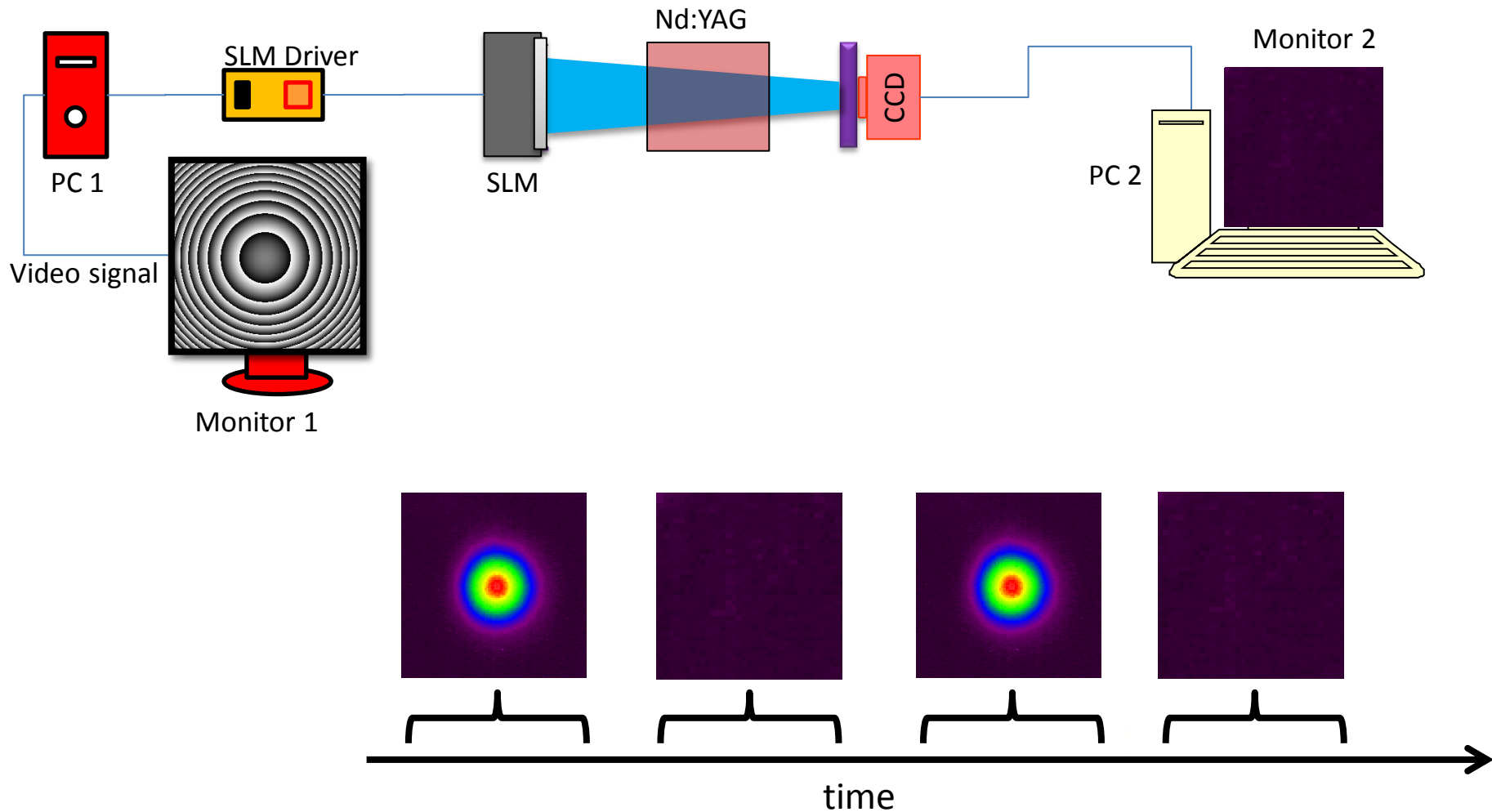


Could the refresh rate also be used? Dynamic beam shapes?



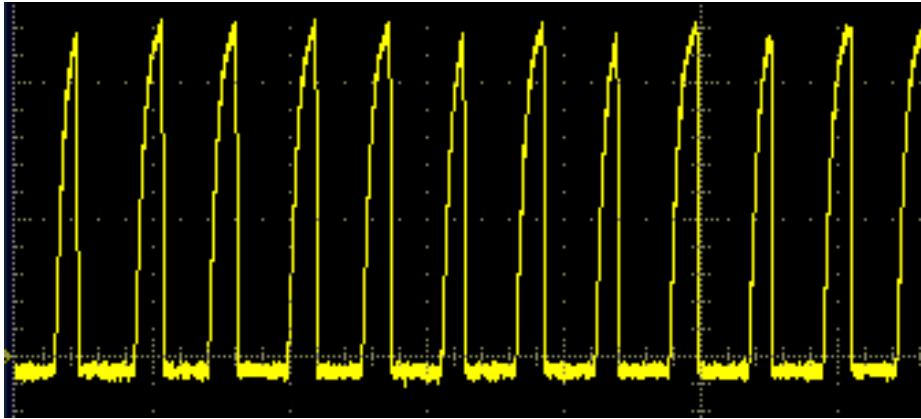


Could the refresh rate also be used? Laser Pulsing?

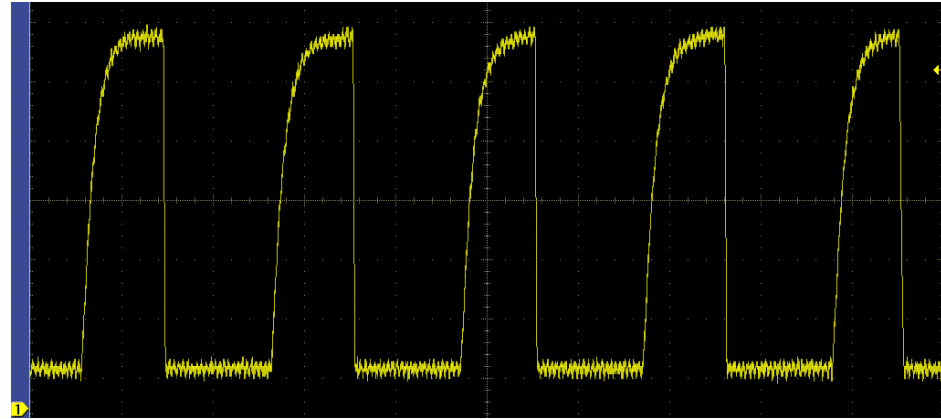


Yes Laser Pulsing is possible

High frequency operation



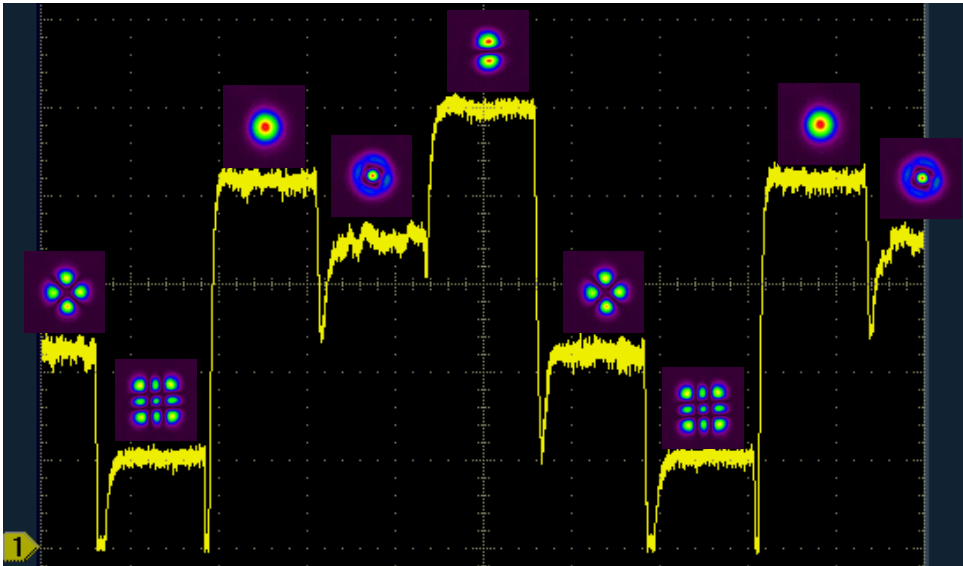
Low frequency operation



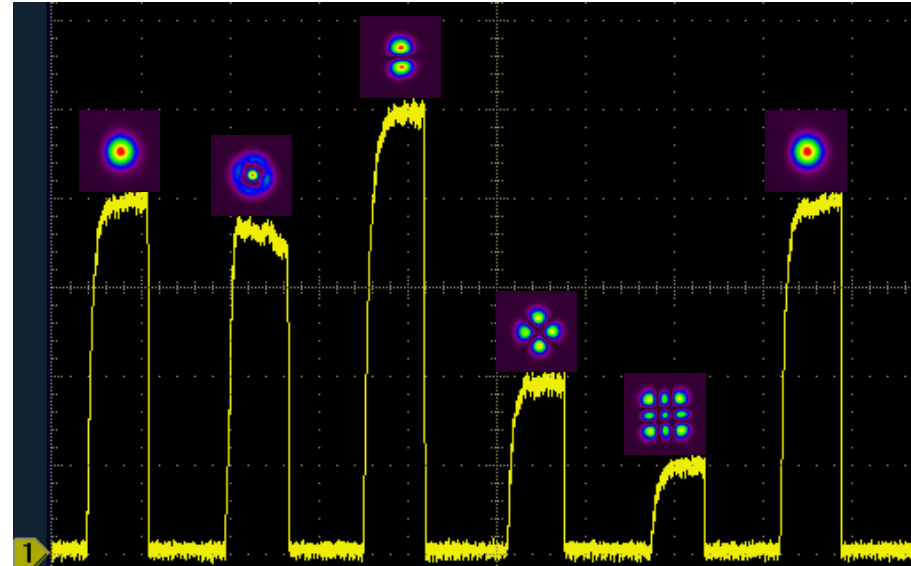
Also both high and low frequency operations could be mixed

On-demand mode pulses is also possible

Continuous operation



Discrete operation



Also continuous and discrete operations could be mixed

Conclusion

- We have successfully developed a laser that can generate on-demand laser pulses of various shape.

Future work

- Increase the modulation speed of the SLM beyond the currently achieved pulse repetition of 5Hz.
- This will also reduce the currently achieved pulse length of 40ms

The End
Thank You

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