DICHROIC FABRY-PÉROT RESONATOR

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FAKULTET ZA FIZIKU

SVEUČILIŠTE U RIJECI

NANORI

EXPERIMENTAL SETUP

TECHNICAL DEMANDS:

BEAMS ARE GENERATED IN THE SAME SOURCE

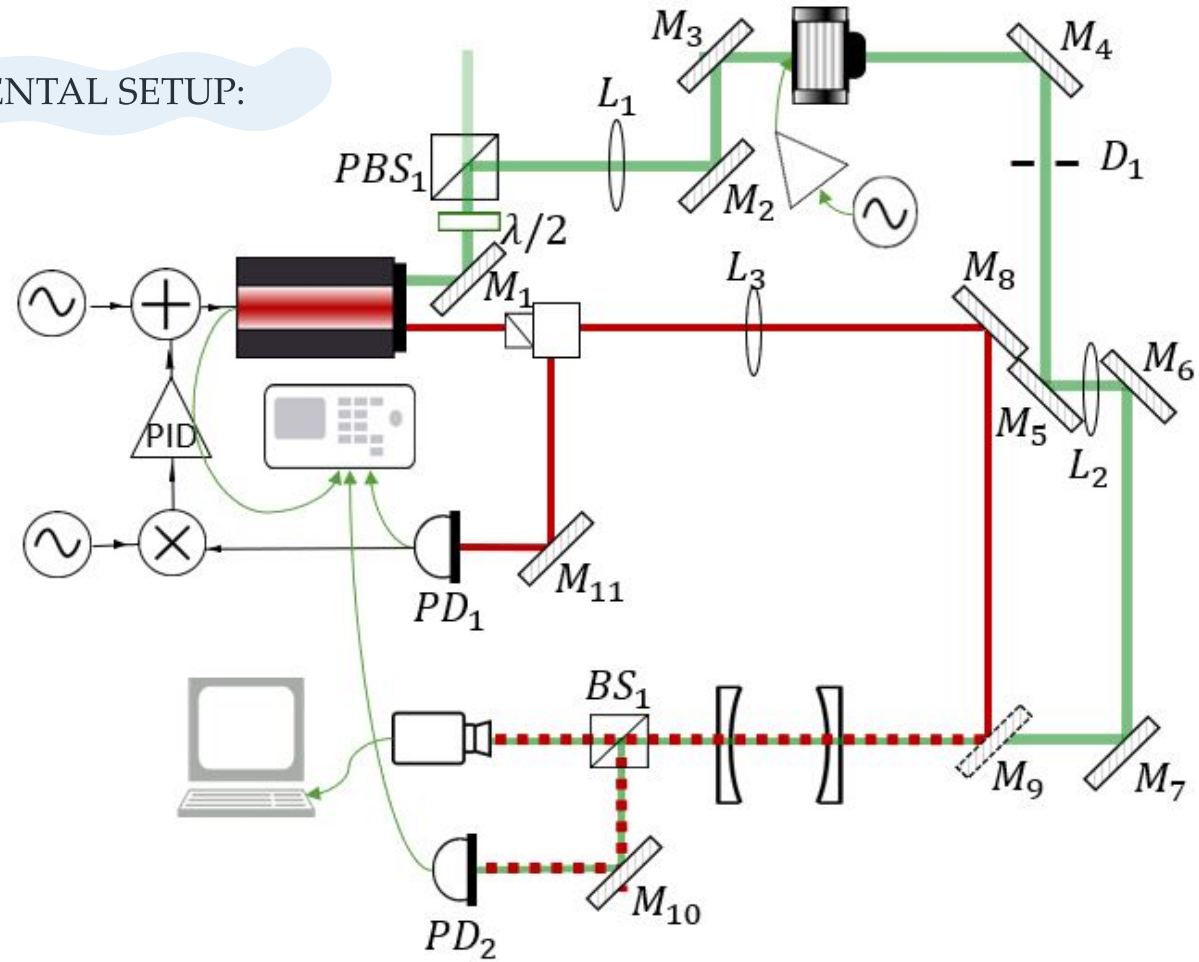
CAVITY LENGTHS ARE NOT EQUAL

POUND - DREVER HALL LOCKING

OUR IDEA:

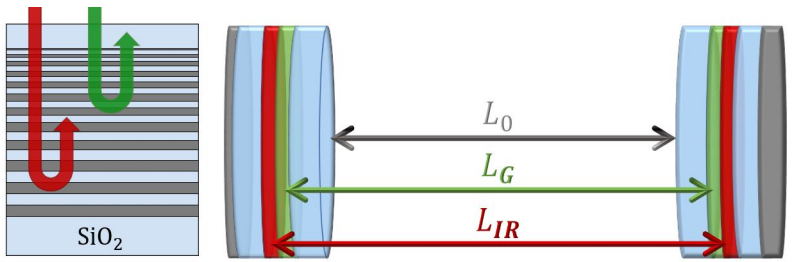
GREEN LIGHT MODULATION WITH ACOUSTO-OPTIC MODULATOR

EXPERIMENTAL SETUP:

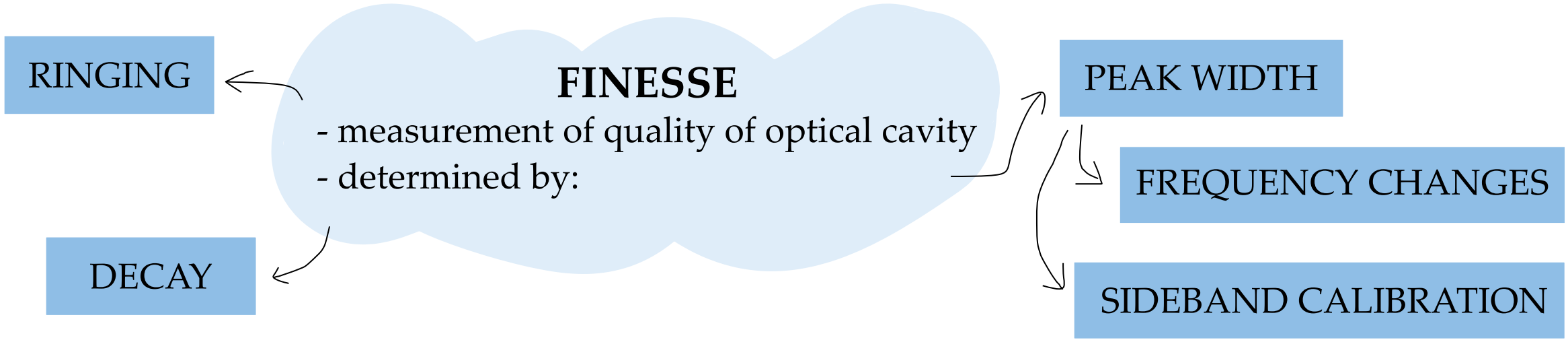


WHY NOT?

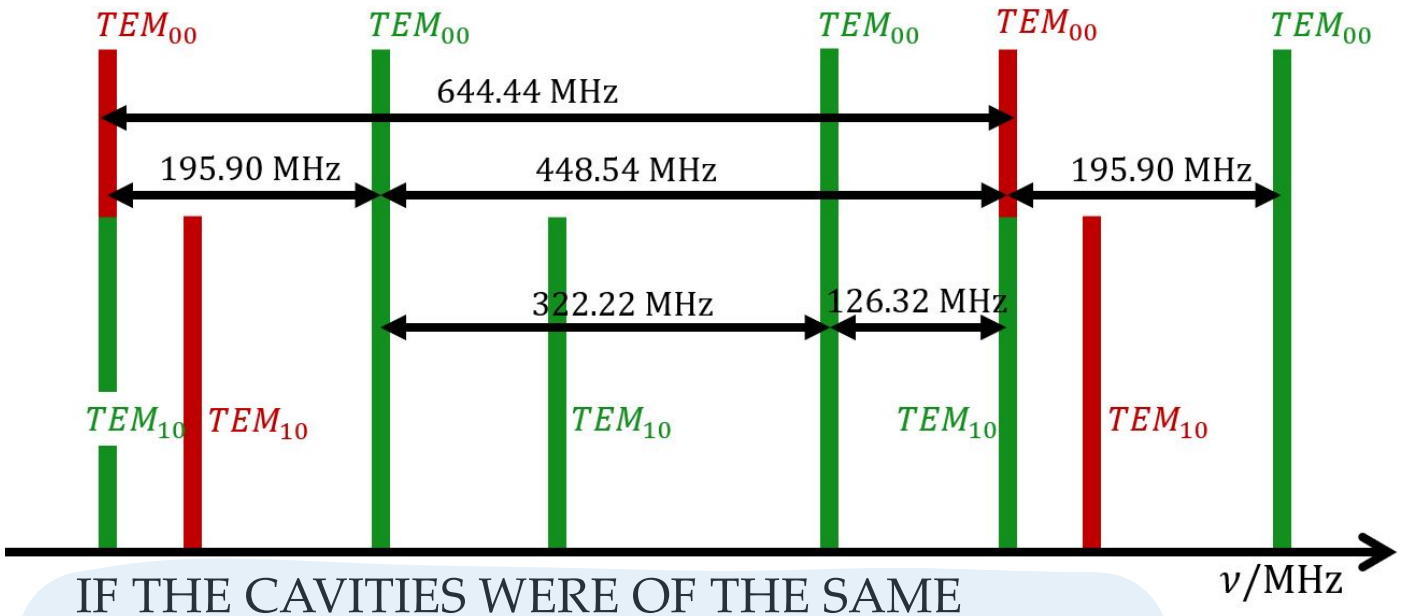
The different wavelengths have different reflection and transmission properties in the dielectric mirror. In other words, beams with different wavelengths are reflected by the different layers of the mirror.



FINESSE



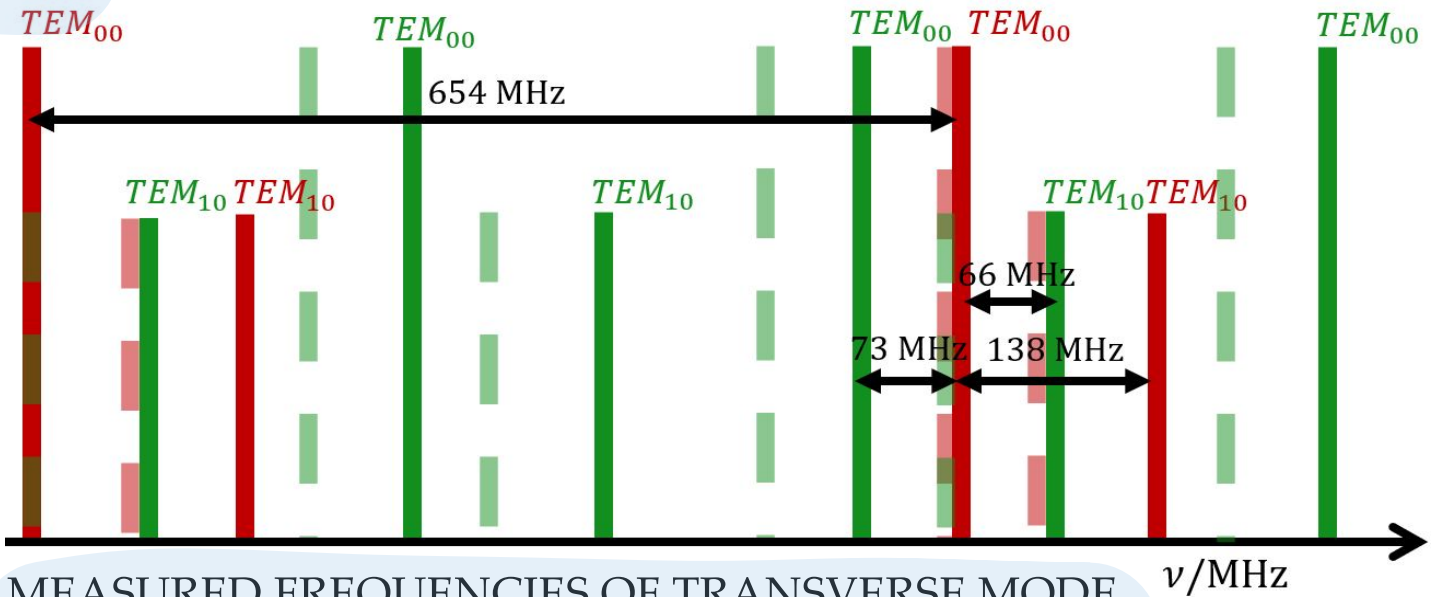
Method	Finesse for green light	Finesse for infrared light
Ringing	not measured	160000 ± 60000
Peak width (sidebands)	19100 ± 200	34300 ± 500
Peak width (frequency changes)	28000 ± 2000	not measured
Decay	117000 ± 4000	not measured



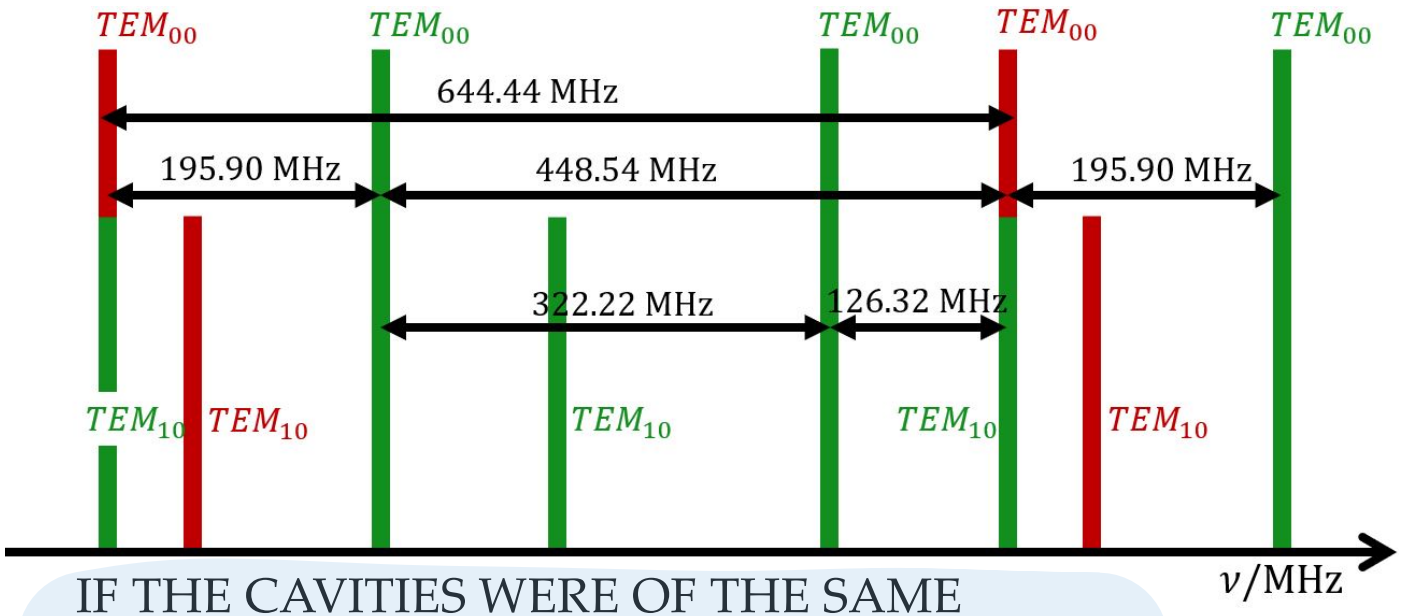
IF THE CAVITIES WERE OF THE SAME LENGHT FOR BOTH WAVELENGTHS

Simultaneous locking of the infrared and green light cavities at TEM00 was achieved when the green light frequency was shifted by 73 MHz.

Note that in the the distance between modes is strongly temperature dependent due to the change in mirror spacing and mirror oscillation.



MEASURED FREQUENCIES OF TRANSVERSE MODE
(dashed- teoretical predictions)



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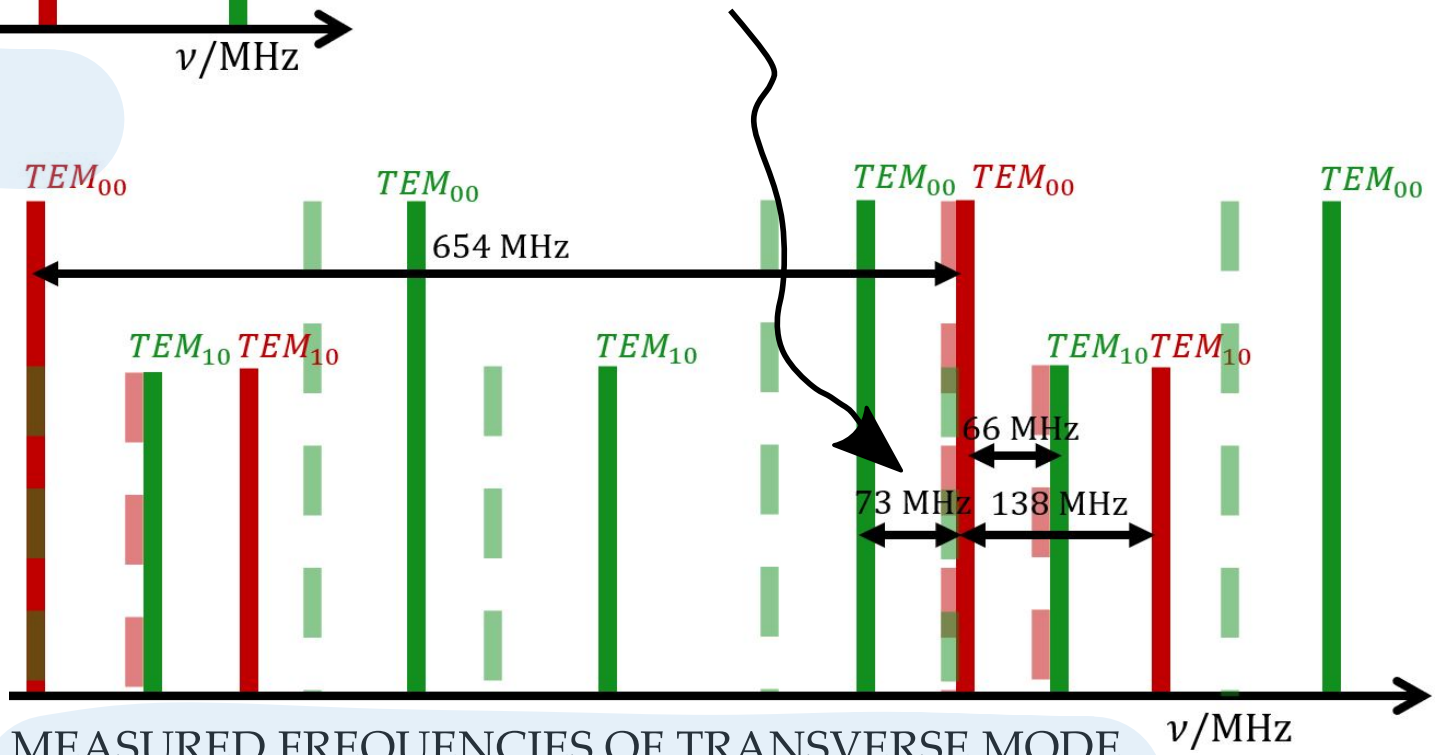

MEASURED FREQUENCIES OF TRANSVERSE MODE
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Conclusion

- achieved locking on two laser beams with different wavelengths simultaneously
- advantage: easy manipulation of the beams
- disadvantage: change of AOM frequency - correction of mirror position

[1] V. Vujnović, D. Jardas, and M. Karuza, "Optical sensing with dichroic resonator," in *2022 45th Jubilee International Convention on Information, Communication and Electronic Technology (MIPRO)*, pp. 238–244, 2022.

[2] J. Poirson, F. Bretenaker, M. Vallet, and A. Le Floch, "Analytical and experimental study of ringing effects in a fabry–perot cavity. application to the measurement of high finesses," *J. Opt. Soc. Am. B.*, vol. 14, pp. 2811–2817, 1997.

[3] F. Della Valle, E. Milotti, A. Ejlli, U. Gastaldi, G. Messineo, L. Piemontese, G. Zavattini, R. Pengo, and G. Ruoso, "Extremely long decay time optical cavity," *Opt. Express*, vol. 22, 2014.