



3D Imaging of Time-Averaged Turbulence

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Motivation

- Observe and quantify atmospheric turbulence in 3D
- To see turbulence at the local scale (100 meters)

Applications

- Air Safety
- Weather
- Fluid Mechanics

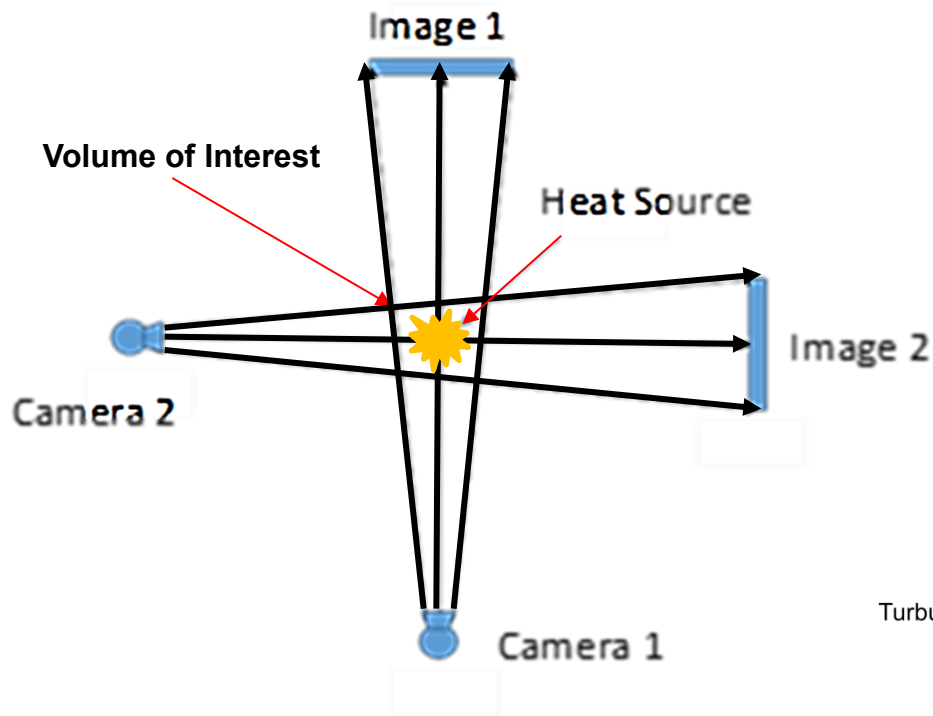


Wake Turbulence induced by a plane after takeoff



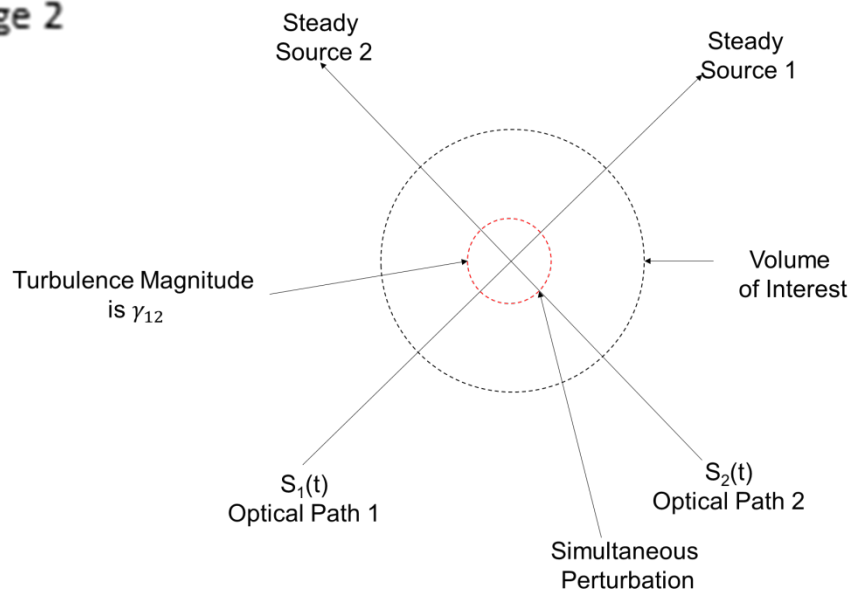
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Experimental Setup



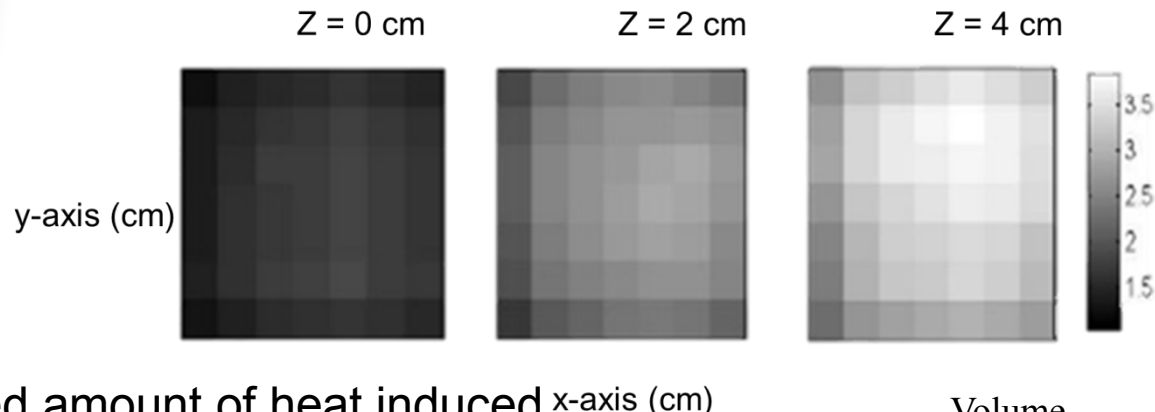
Principle: Cross Correlation

$$\gamma_{12} = 1/T \int (S_1(t) - \langle S_1 \rangle)(S_2(t) - \langle S_2 \rangle) dt$$





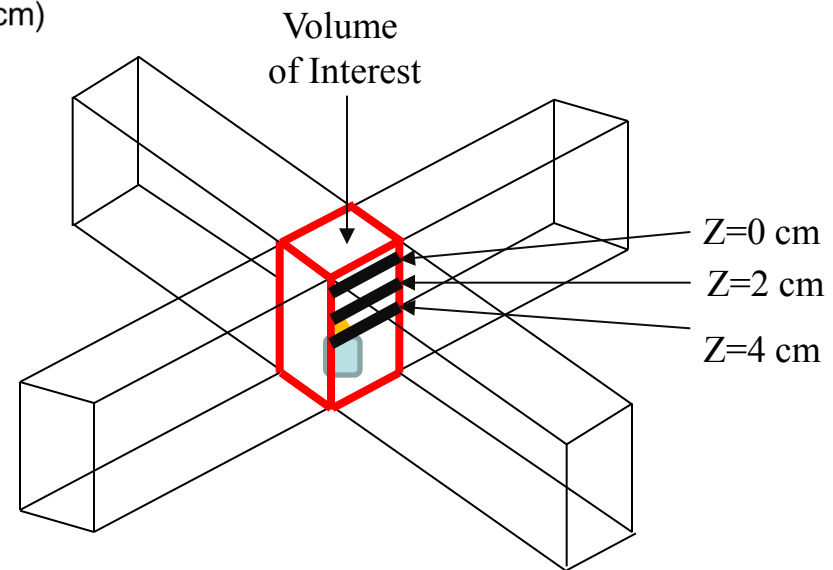
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- Computed amount of heat induced turbulence for three different altitudes.
- Turbulence increases with altitude around a candle flame.

Conclusion

- 3D image of the time-averaged turbulence
- Based on far field observation
- Technique can be transferred to airplanes



[1] John K. Williams, Larry B. Cornman, Jaimi Yee, Steven G. Carson, Gary Blackburn, and Jason Craig, "NEXRAD Detection of Hazardous Turbulence", American Institute of Aeronautics and Astronautics, Inc., pages 1-2, (2006).

[2] Gordon Valentine. "When the seatbelt sign goes on, it doesn't mean to get up and stretch." Sluggo's Journal. Page 1. (2010)