Abstract Submitted
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Scaled experiments for improving diagnosis of pathological lower-airway obstruction[1] CHANG LIU, KEN KIGER, Univ. of Maryland, DANIEL HARIPRASAD, BORA SUL, ANDERS WALLQVIST, JAQUES REIFMAN, Biotechnology HPC Software Applications Institute — Many lung diseases, such as asthma and chronic obstructive pulmonary disease, are characterized by obstructed airflow, particularly, in the lower airway branches in the lung. Existing diagnostic tools cannot detect some diseases due to a lack of instrumentation capable of resolving the flow in the lower airways. Recent developments in MRI techniques using hyperpolarized ^{3}He now permit measurement of velocity profiles within the trachea. Motivated by these advances, we aim to provide a better understanding of the connection between lower-airway obstruction and velocity profiles within the trachea. Specifically, we asked whether the flow deficits created by lower-airway obstructions could be detected in the trachea to permit diagnosis of the pathology. To test this idea, we used refractive index-matched materials to construct a scaled, patient-specific, transparent lung model, and coupled it to 5 independently controlled piston pumps that could generate arbitrary flow histories (healthy or diseased) for the 5 different lung lobes. Results obtained by stereo PIV within various regions of the airway network will be presented documenting the system performance and examining the detectability of under-performing lobes within the tracheal flow profile.

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Ken Kiger
Univ. of Maryland

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