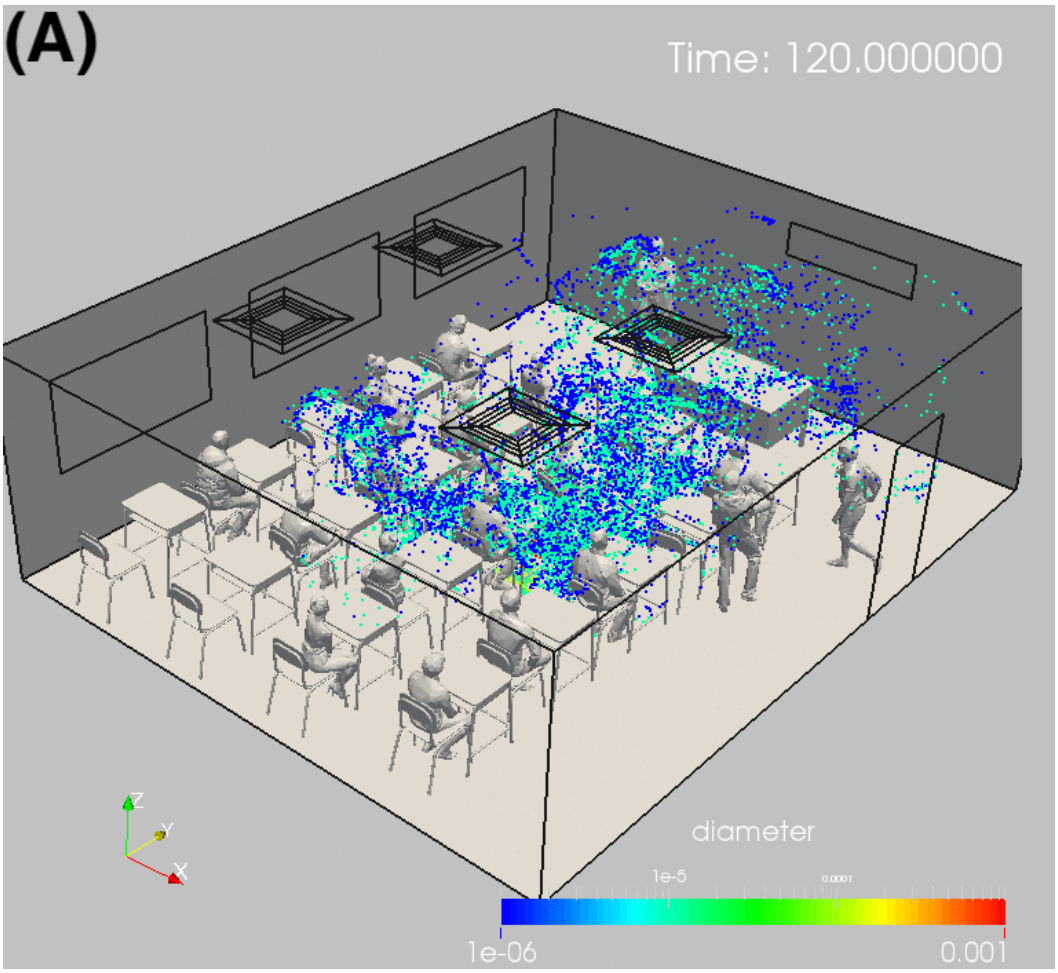
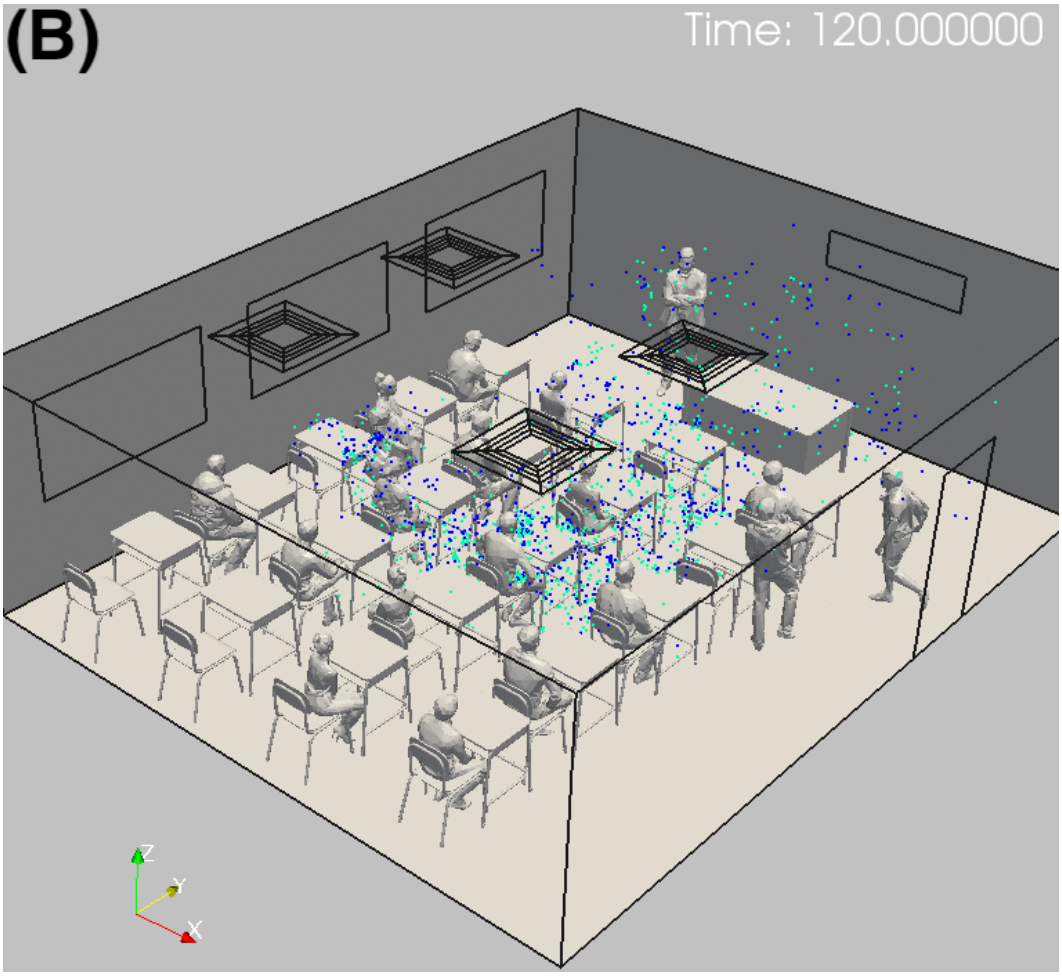
**Research Highlight**
**Covid-19/Spread of Diseases in the Built Environment**

Dr. Harbir Antil (supported by DMS awards 1818772 and 1913004) together with Dr. Rainald Löhner has simulated air flows under various settings in an effort to understand, minimize and suppress the spread of pathogens such as COVID-19. The flow and particle movement has been modeled by coupled nonlinear partial and ordinary differential equations (PDEs and ODEs), allowing exchange of mass, momentum and energy. Their current focus is on optimizing ventilation systems so as to inhibit or remove pathogen transmission and optimal sensor placement in order to detect the maximum possible number of cases with a given number of sensors.

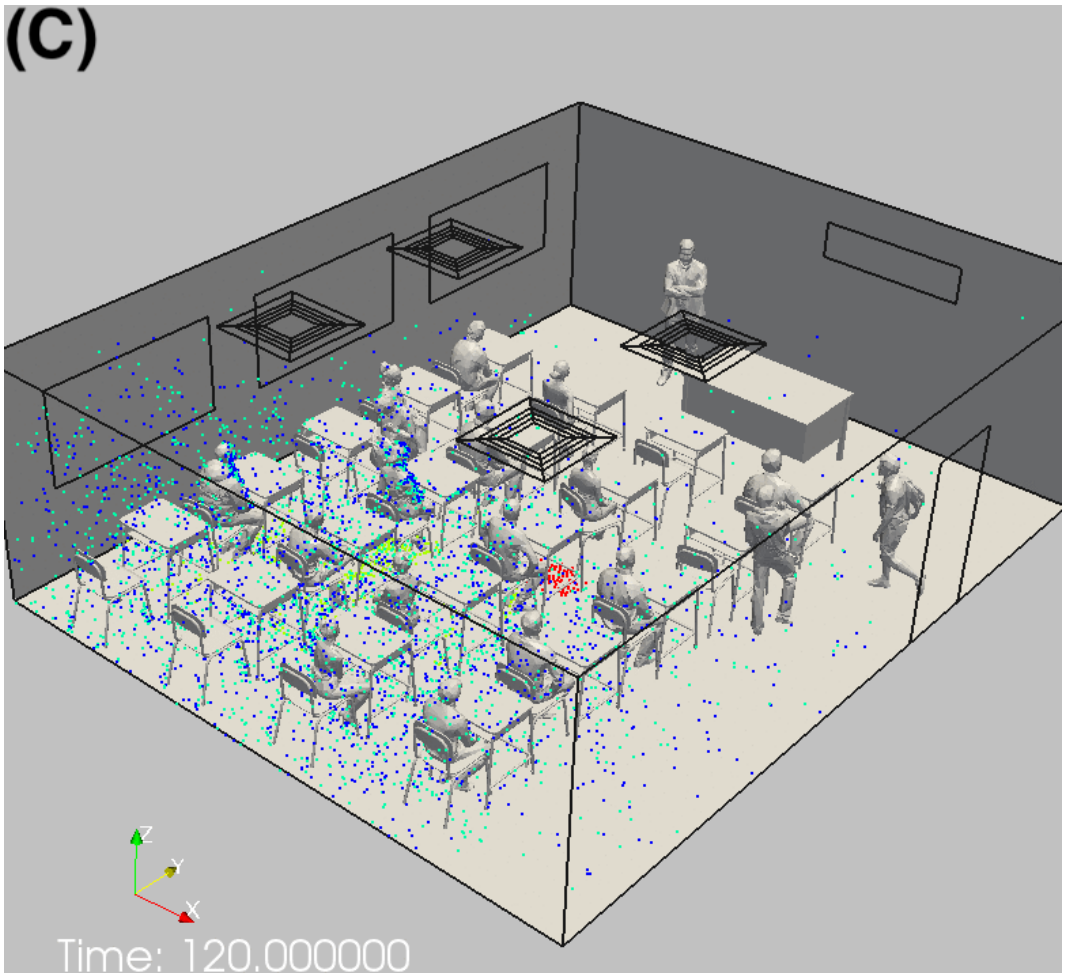
The figures below illustrate the impact of proper ventilation and mask usage after a student coughs or sneezes in the middle of a classroom. Other settings have been considered including hospital rooms, airport security queues, subway trains and passages, and courtrooms. More simulations and references may be found here.



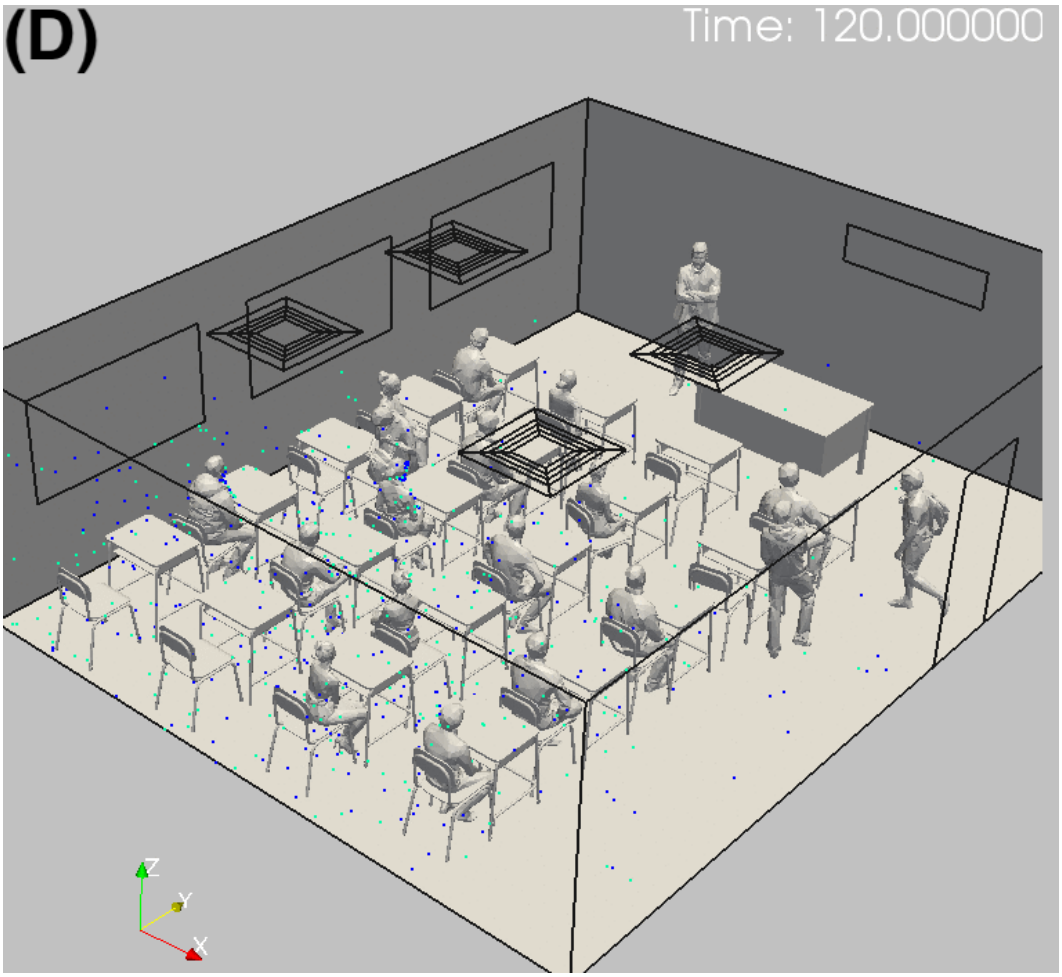

(A) Under normal ventilation conditions, the large particles (red, green) settle near this student, but the smaller ones (cyan, blue) quickly spread everywhere.



(B) Wearing a mask removes all large particles and drastically reduces the emission of smaller ones.



(C) Opening doors and windows improves the situation in (A), but some particles still remain.



(D) Combining (B) and (C) achieves the highest reduction in the amount of particles in the air and hence the infection probability.