

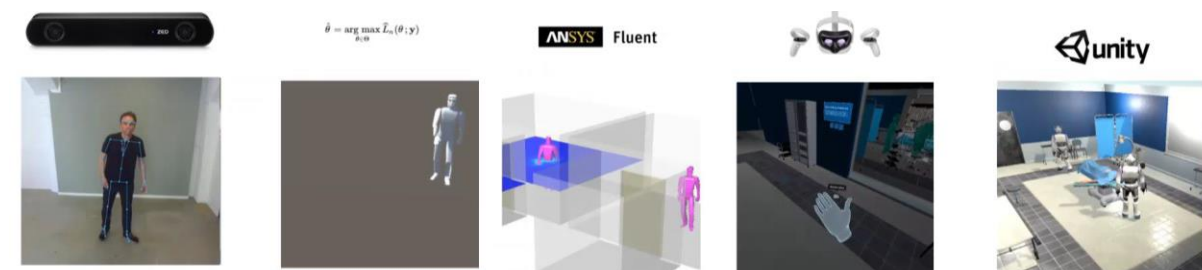
# Tomorrow's Ventilation Solutions for Future Hospital Demands

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## SUMMARY

At hospitals and healthcare buildings, the ultimate objective is to save lives. According to the 2018 annual reports from the Norwegian Institute of Public Health, the incidence of postoperative wound infections (POSI) ranged from 1.6% to 13.4% depending on the surgical procedure. Surgical Site Infections (SSI) are severe complications in hospitals worldwide and Norway. SSI contributes to large societal costs through extended hospitalization, increased need for reoperation, and less participation in working life. The high occurrence of SSI increases the need for antibiotics, both preventive and treatment, increasing the risk of developing antibiotics resistance bacteria. Although it is well-known that most SSIs are caused by germs, the transport mechanism of such microorganisms is still a matter of debate. Recognizing the critical need for improved safety measures, Norconsult embarked on a groundbreaking project.

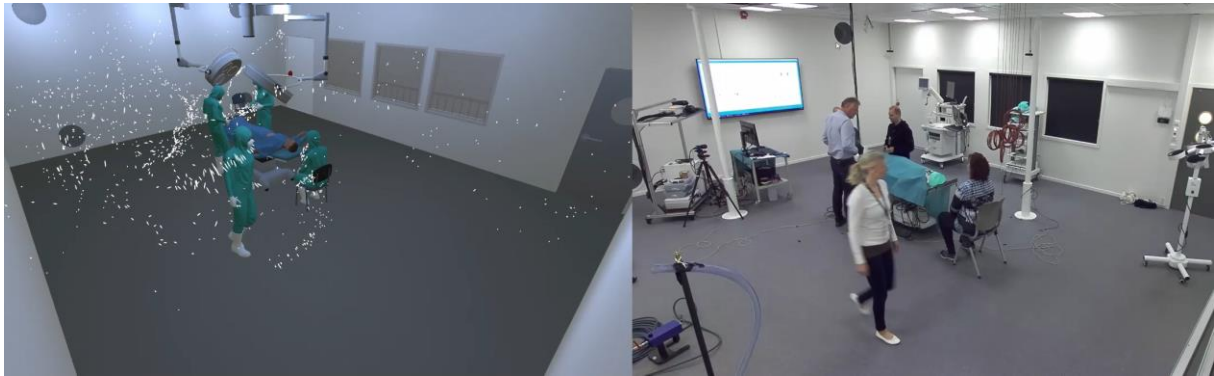


Norconsult's primary goal was to enhance the visualization and understanding of particle generation and ventilation flows within a 60m<sup>2</sup> operating room. To achieve this, they are developing an innovative Extended Reality (XR) solution. XR is a collective term for technologies that combine the real world with virtual elements. This cutting edge technology captures the dynamic interaction between healthcare personnel's movements and the virtual airflow and particle distribution in real time.

XR Technology can be used to visualize contaminants within an operating environment to increase staff awareness regarding their activity linked to air movement and airborne particle levels. The presented project has developed an XR tool to translate the numerical simulation results into an easy-to-understand 3D domain to increase the understanding of the interaction between the healthcare personnel and the operating room ventilation. Such dynamic behaviour is mapped using AI (Artificial Intelligence) powered stereo cameras and particle counters, which is then transferred to state-of-the-art Computation Fluid Dynamics (CFD) analysis. To further validate the results an ultra-clean operating room, 1:1 – 60 m<sup>2</sup>, was build.

The operating laboratory is equipped with innovative particle reduction solution, that reduces the outside contaminants entering the operating room by more than 99%. Most importantly the operating room is equipped with possibilities to use different of ventilation solutions – Mixing Ventilation (MV) and a Laminar Air Flow ventilation (LAF) or a combination of this ventilation system.

Results from the solutions and measurements shows that in steady state measurements it is 50 times more particles in the wound with mixed ventilation than with laminar airflow ventilation. In the presentation more results will be shown for transient simulations and with operating persons moving around in the operating room.



Here medical staff and students can train to increase their knowledge and understanding about the airflow fields and airborne particles with the use of different ventilation system and their work practice on the level of contaminants within the operating room simulated in an interactive virtual environment.

### **KEYWORDS**

SSI, AI, CFD, XR

### **ACKNOWLEDGEMENTS**

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