

Fluid Dynamic Analysis of the Multi-Lumen Thoracic Catheter

S. Budar¹, A. Ritter¹

1. Stevens Institute of Technology, Chemistry, Chemical Biology & Biomedical Engineering, Hoboken, NJ, USA

Introduction: Thoracic catheters are used in hospitals all over the world but are plagued with complications. Catheters will easily become clogged, cause infection, and induce severe patient pain. This novel Multi-Lumen Thoracic Catheter (MLTC), incorporates additional lumen within the wall of the catheter to address the aforementioned issues.

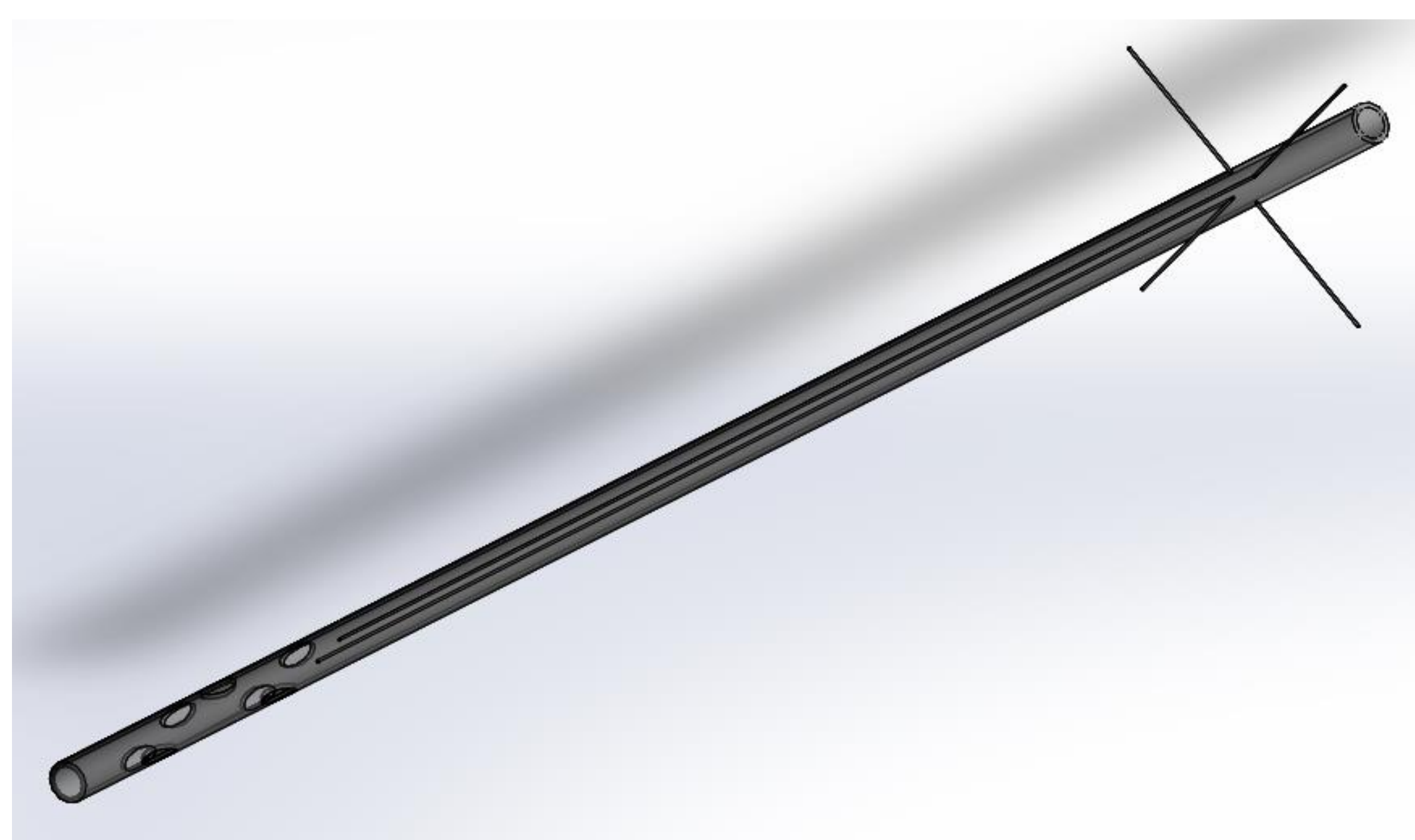


Figure 1. Multi-Lumen Thoracic Catheter

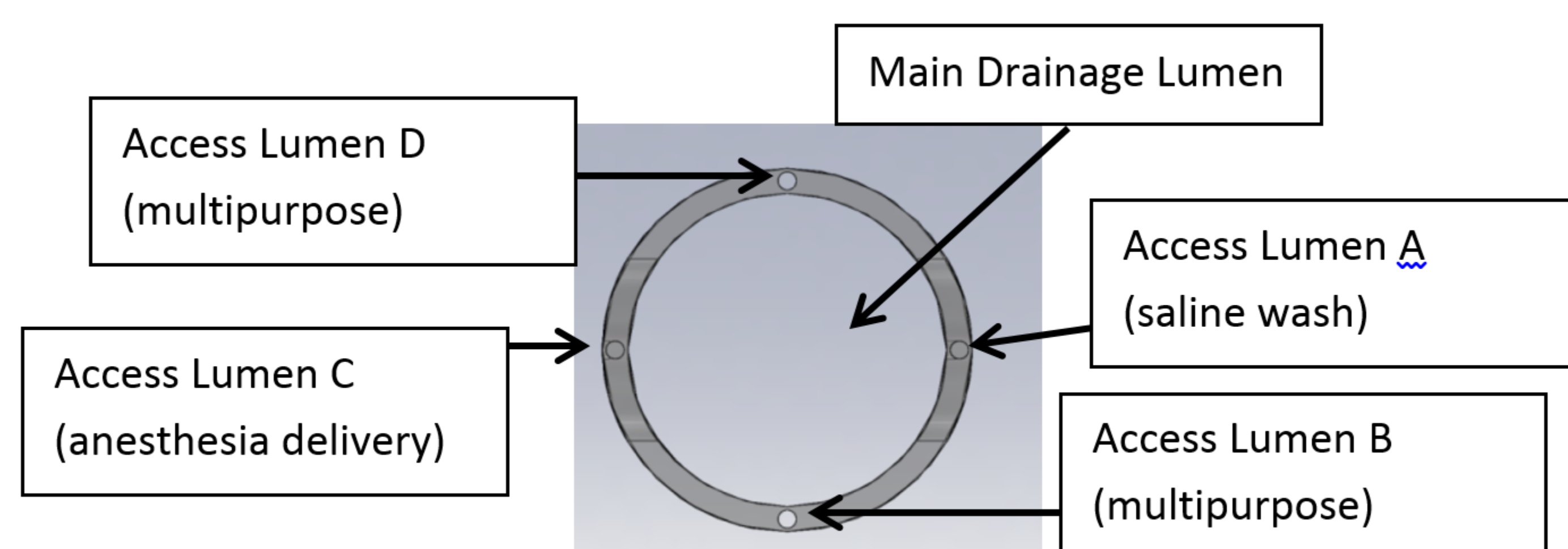


Figure 2. Cross-Section of MLTC

Computational Methods: Taking advantage of COMSOL's LiveLink with Solidworks, design optimization studies for the MLTC were able to be conducted with ease. Fluid dynamics analyses were performed on each of the design iterations to ensure that the termination points, lumen placement and diameters maximized drainage through the catheter.

Results: It was established that even with the additional flow through the access lumen, the flow rates and pressure profiles of the MLTC were comparable to that of standard thoracic catheters.

Results (cont.): It was also determined that the drainage efficacy of the MLTC was relative to standard catheters.

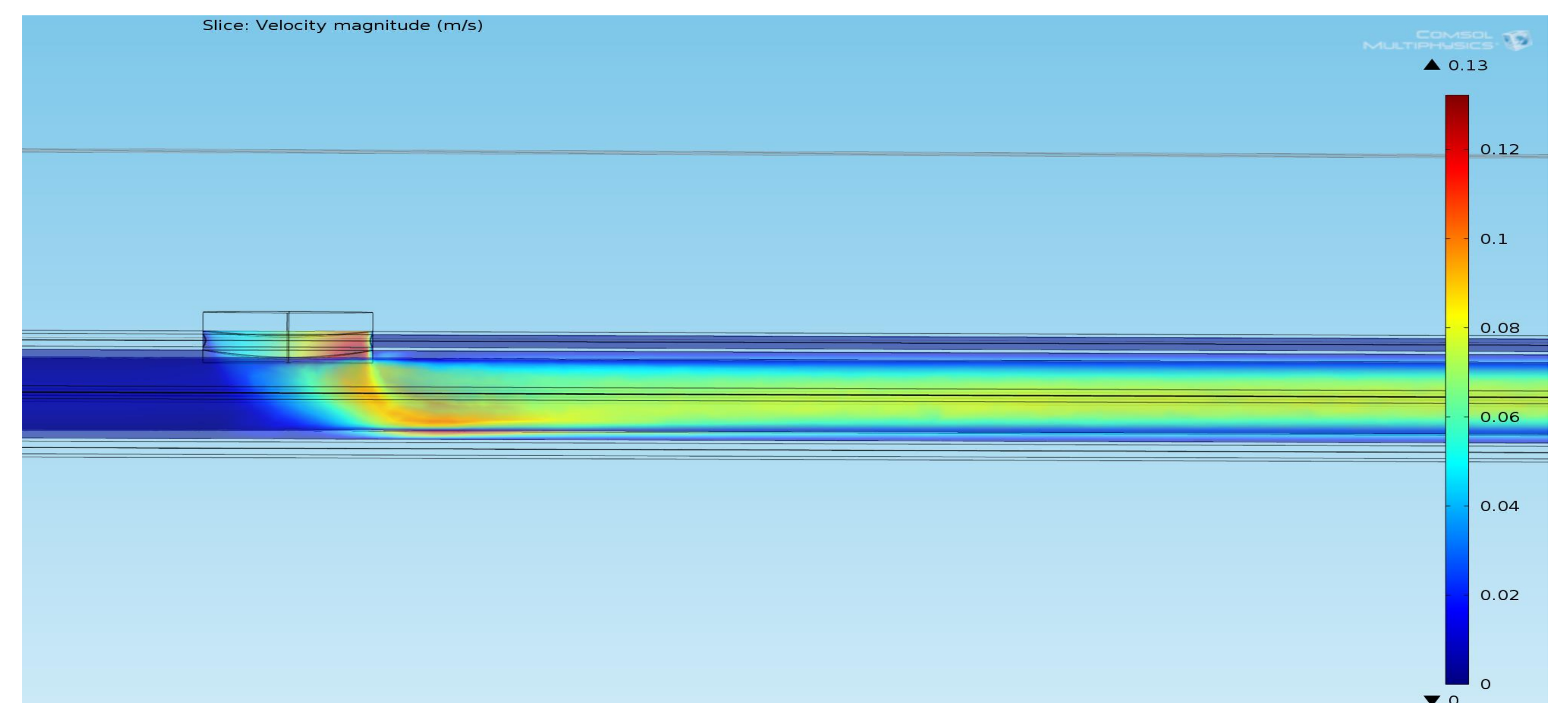


Figure 3. Velocity of Flow Through the MLTC

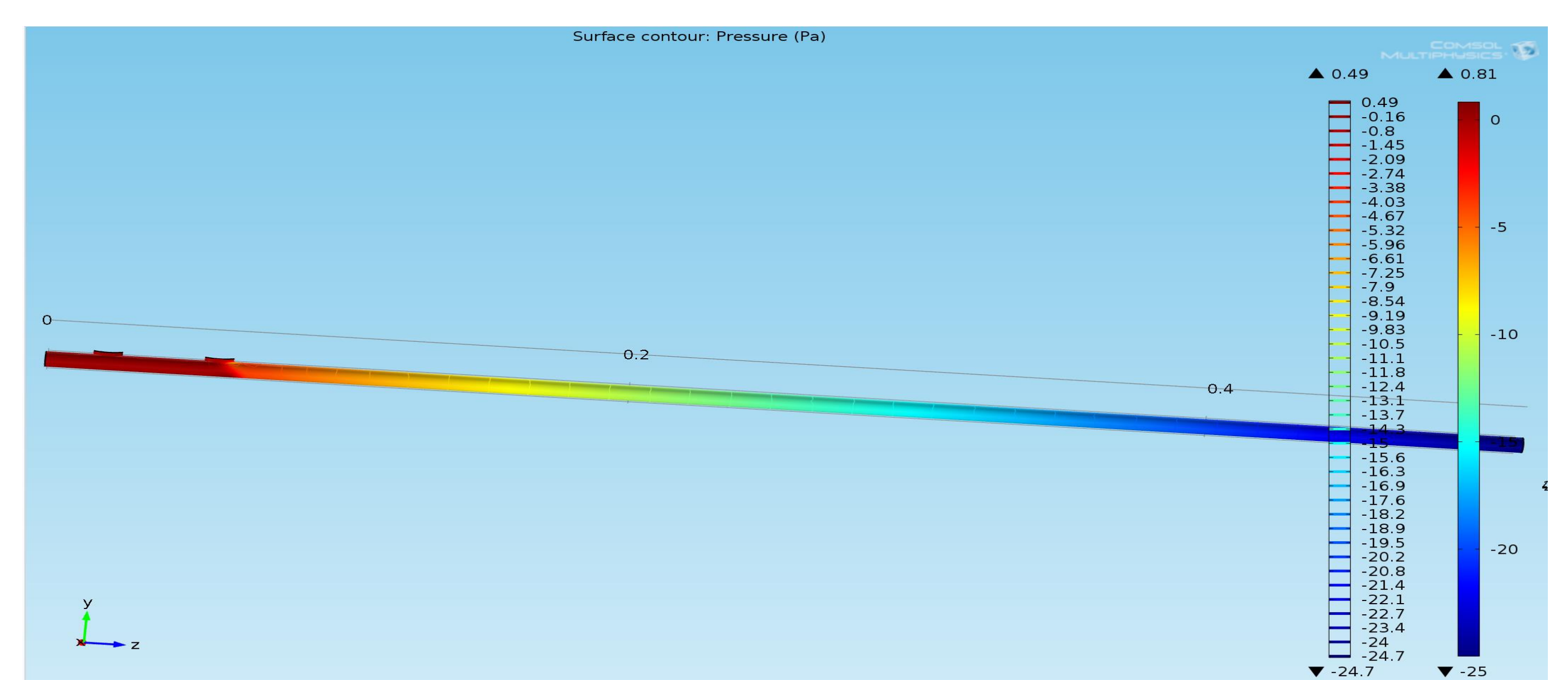


Figure 4. Pressure Change Over the MLTC

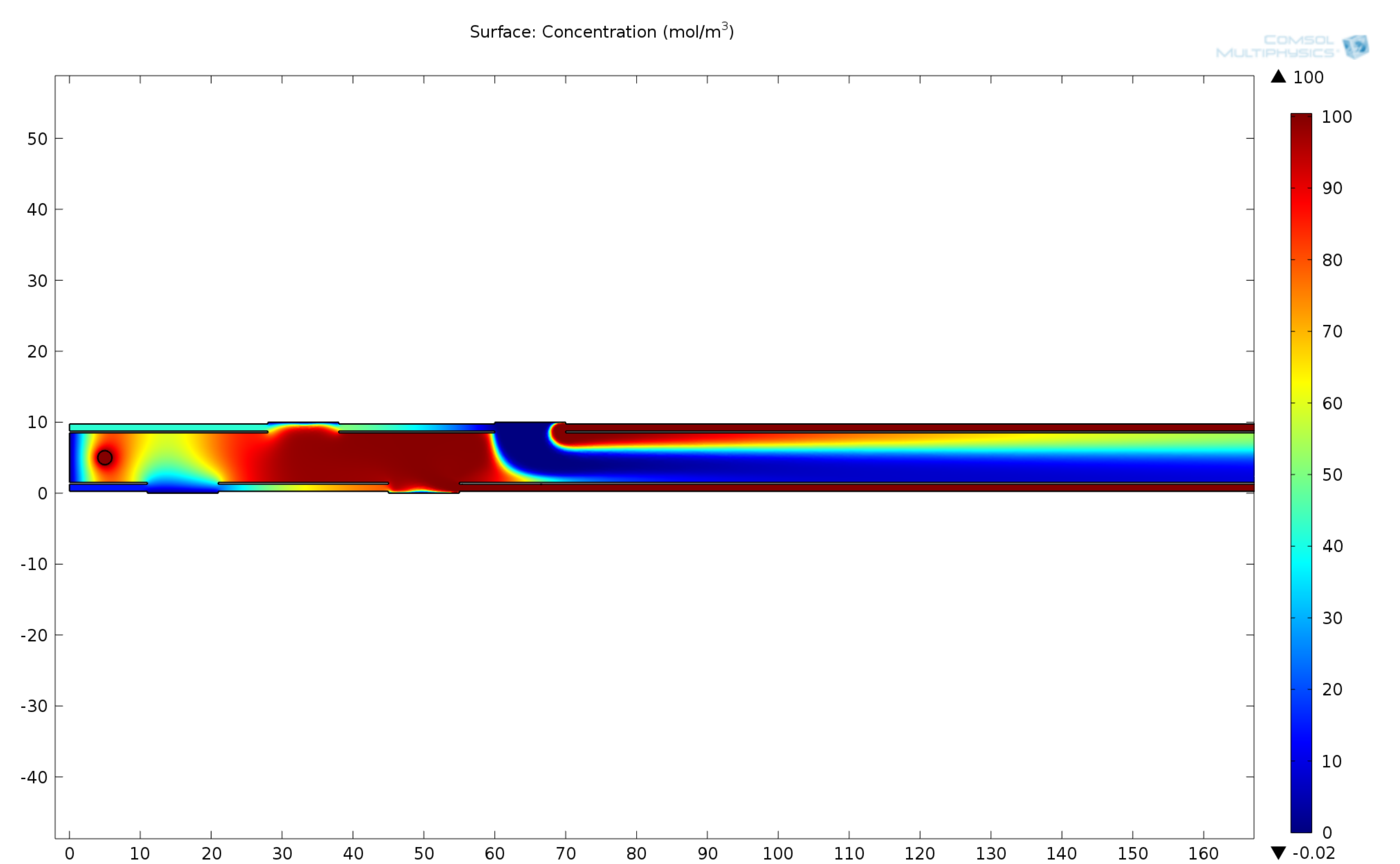


Figure 5. Concentration of Injected Fluid

Conclusions: This catheter has the potential to revolutionize thoracic catheters on the market today. And to that end, the simulations conducted in this study allowed for the creation of an optimized Multi-Lumen Thoracic Catheter. The next step for this catheter would be to take this optimized design and continue on to clinical trials.