



C2D Solutions Pte Ltd

Concepts To Design Solutions

Overview of C2D

C2D Solutions Pte Ltd is a holistic knowledge-based engineering solutions provider with a wealth of experience. We are committed to deliver the most optimal solution based on sound engineering principles.

Problem Statement

The users of an existing 25m and 100m in-door firing ranges have raised issues about the recirculation of gun firing fumes and particles back to the firers, as well as a lack of thermal comfort in the range.

Challenge

The lack of thermal comfort is mainly because the MV air supply is non-conditioned. The fully enclosed nature of the range and the often high occupant loads require the supply of conditioned air instead. Furthermore, the orientation of the original supply grilles and the supply rate caused a lot of recirculation around the firing positions. To mitigate this, an air-conditioned supply system was proposed by the client. However, the proper flow sizing, location and orientation of the air-con supply needed to be verified before construction, in order to save cost and time.

Solution

Detailed Computational Fluid Dynamics (CFD) was used to analyze the thermal and flow phenomena. The predicted flow field and temperature distribution was analysed to ensure good thermal comfort and minimal recirculation around the firers, while maintaining a conducive air velocity around the firer (0.15m/s to 0.2m/s).

Results

The CFD results show that the cooling capacity proposed is sufficient. But the air velocities at the firers' position were above the stipulated flow velocity. Using CFD, various configurations of supply flow rate and grille orientations were analyzed. After several iterations, the targeted velocity and minimal recirculation was achieved while maintaining a good level of thermal comfort.

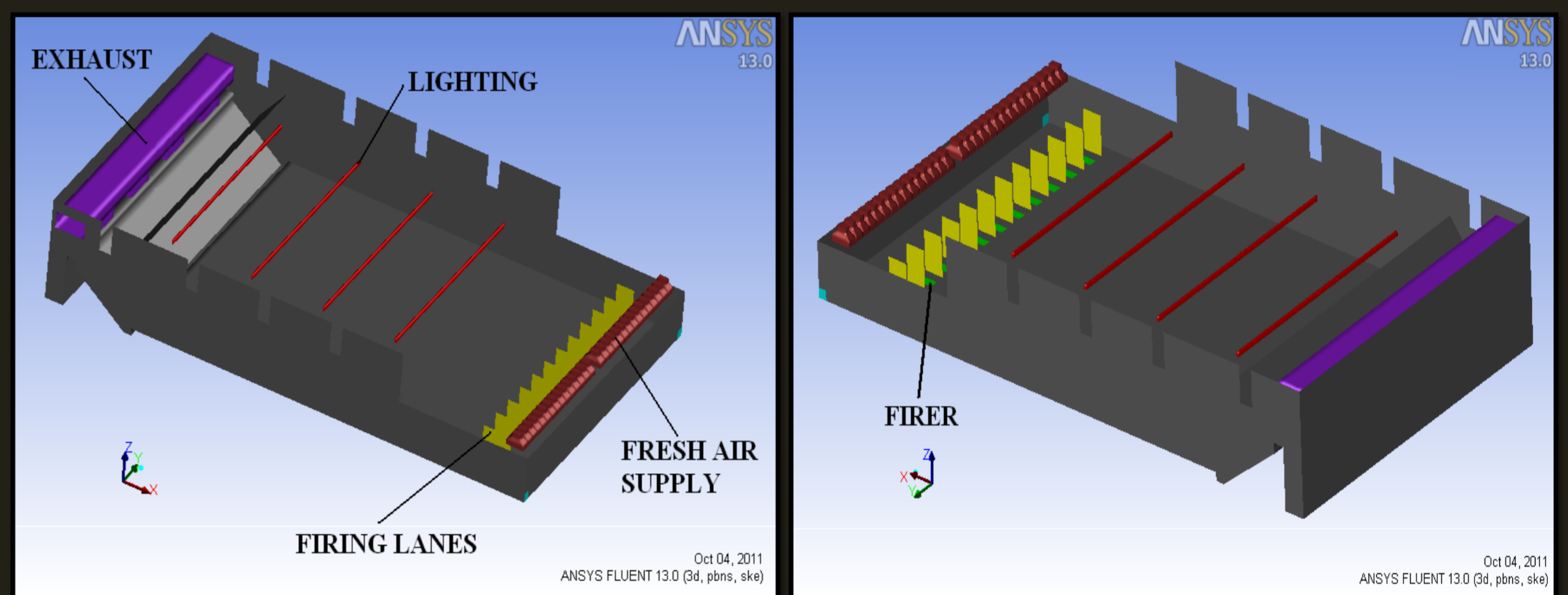


Fig 1: Computational Domain of the 25m Firing Range

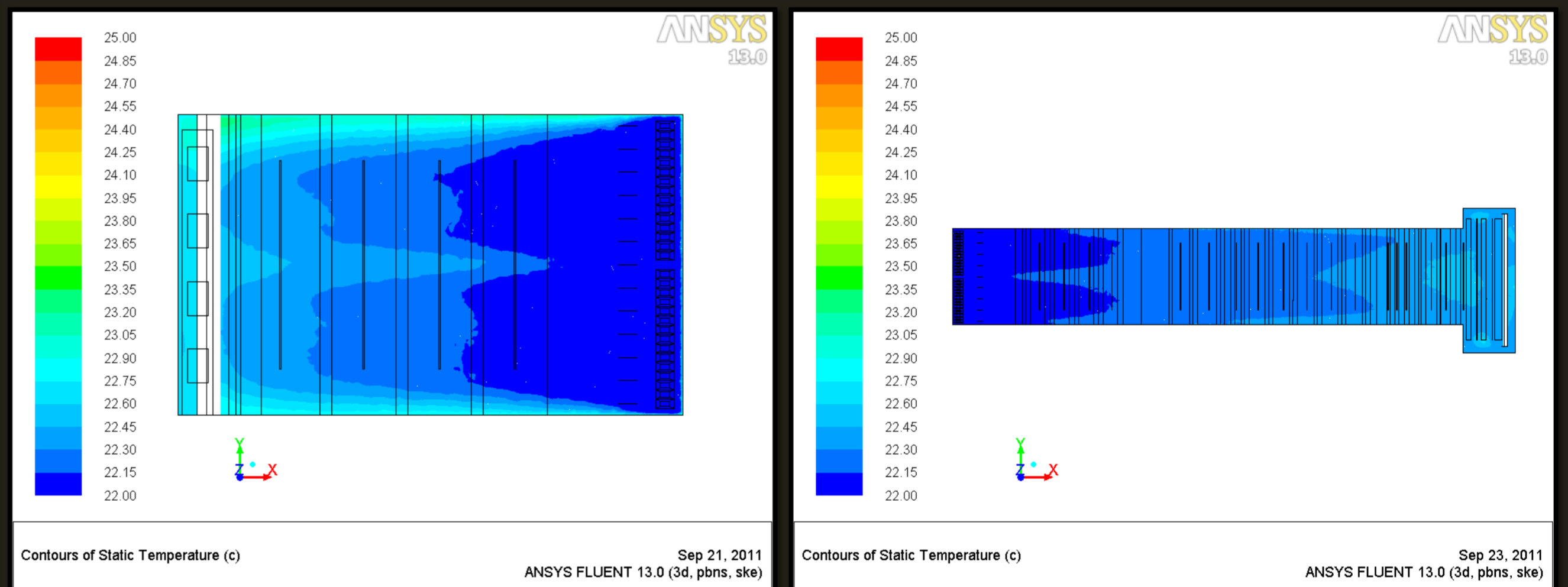


Fig. 2: Temperature Contour in 25m and 100m Range (1.5m Height)

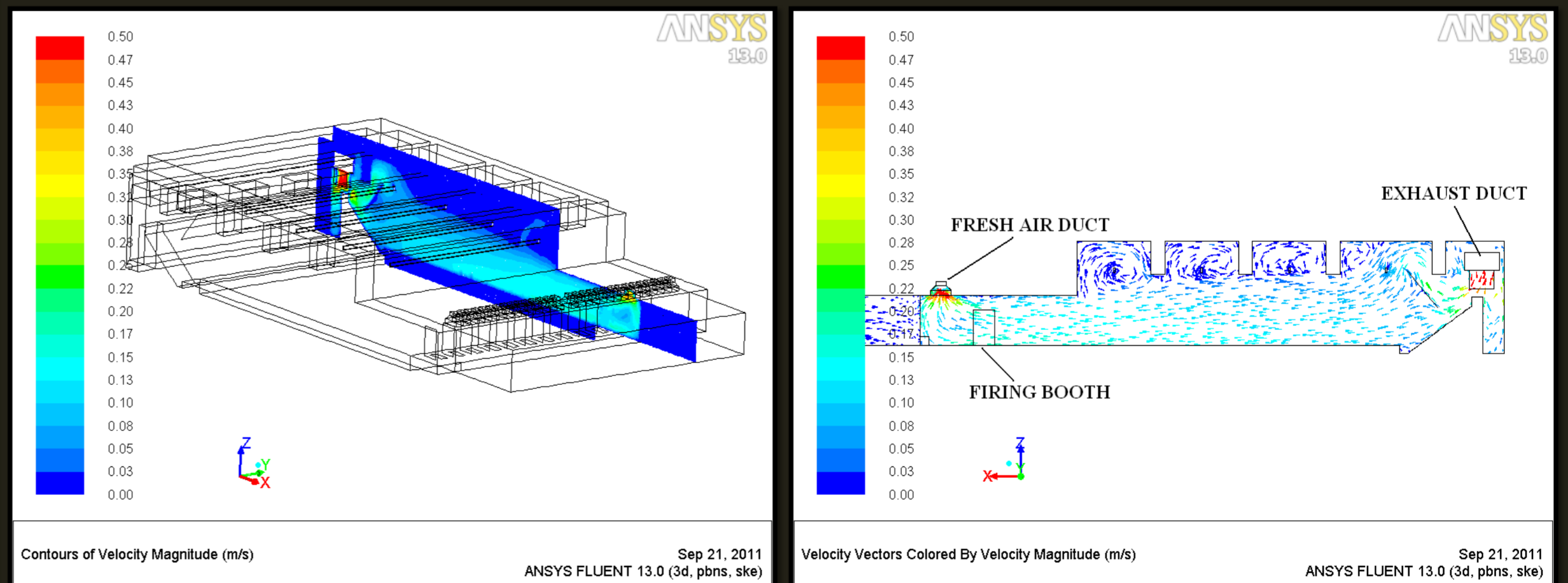


Fig. 3: Velocity Contour and Vector Plots