

Flare System Pressure Drop Calculations Using COMSOL

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Introduction: For the purpose of designing a low pressure flare system, COMSOL Multiphysics is used to validate and check the design of a header transporting ammonia gases released from pressure safety valves (PSVs).

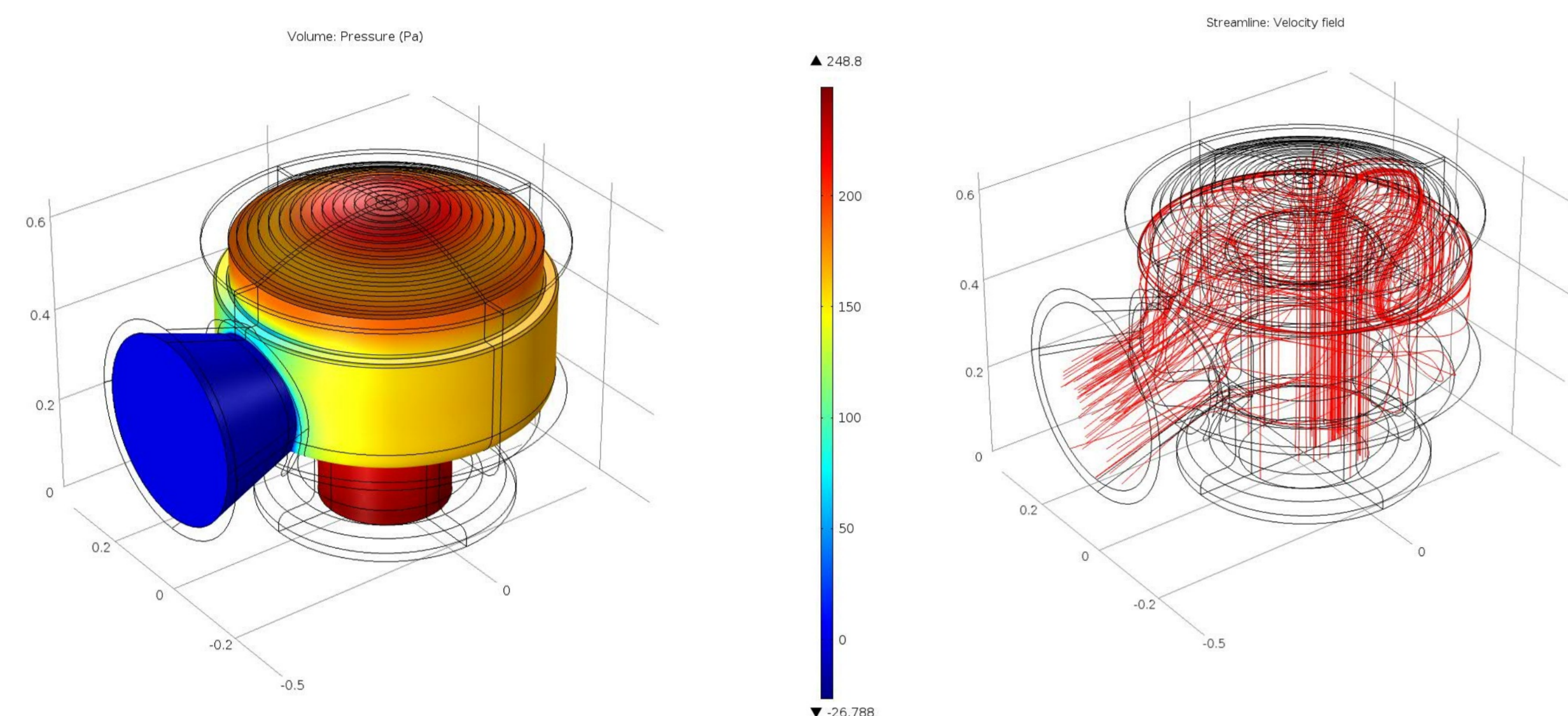


Figure 1. Safety valve pressure and streamlines

Computational Methods: Due to the use of dual function valve and the low pressure requirement, the PSV valve, see figure 1, and the connections to the flare, see figures 2, 3 and 4, are modeled in COMSOL to calculate pressure drop and to check the flow stream lines. Many design parameters were used to find the optimal connections. The profiles were useful in identifying the locations of vortices in the header, which may indicate possible mechanical stresses and/or pressure losses.

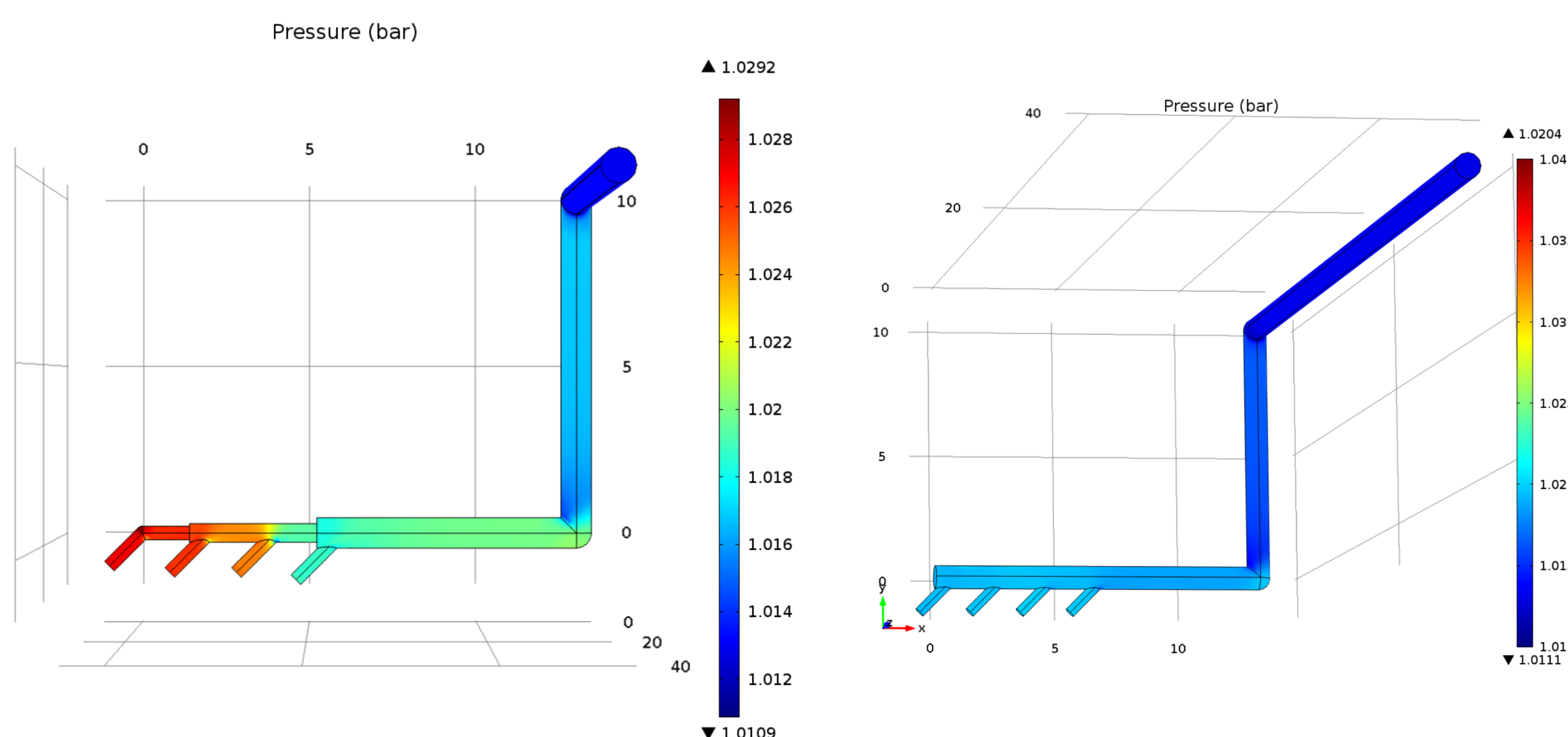


Figure 2. Two Different Flare Header Designs, pressure distribution

Results: Different design alternatives have been investigated and evaluated. The investigation considered different opening scenarios.

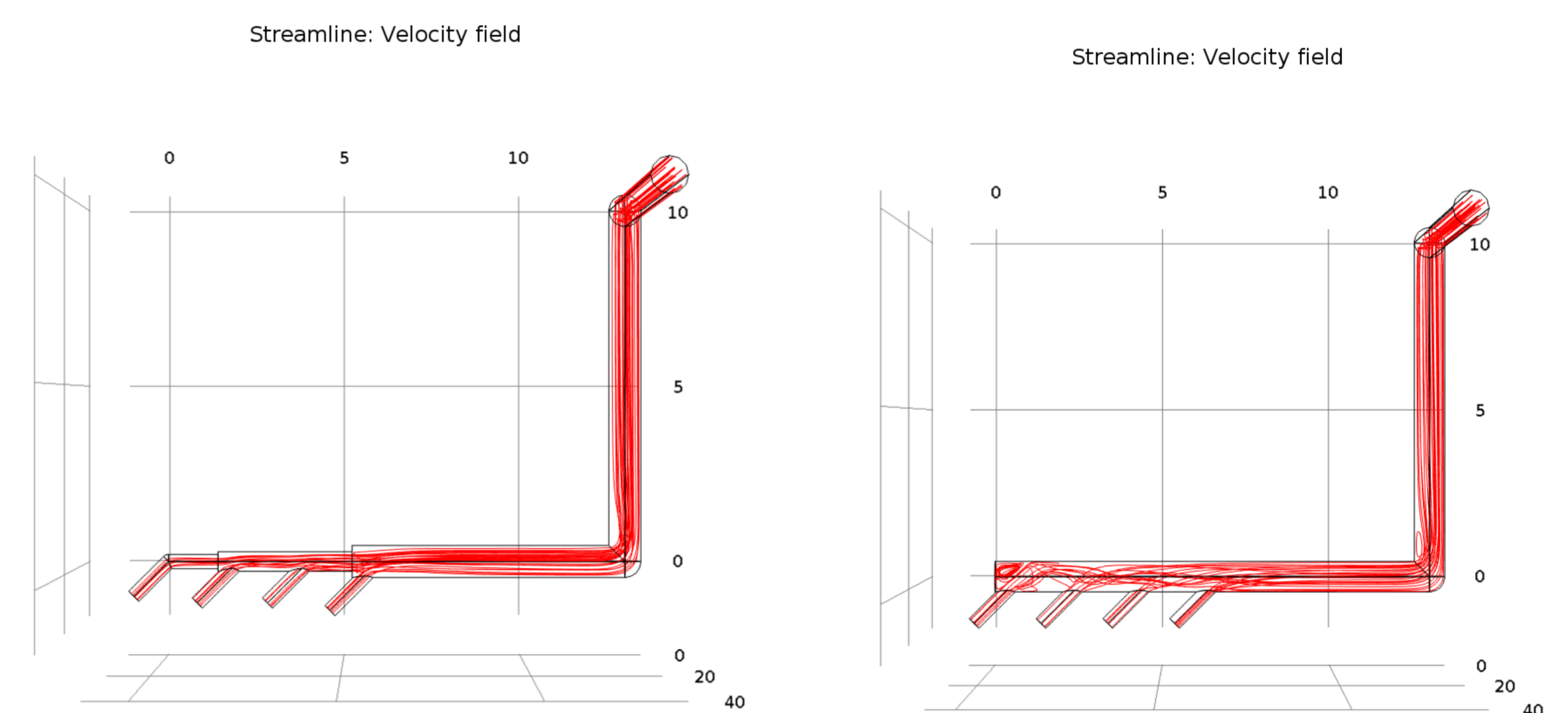


Figure 3. Streamlines through two different flare design

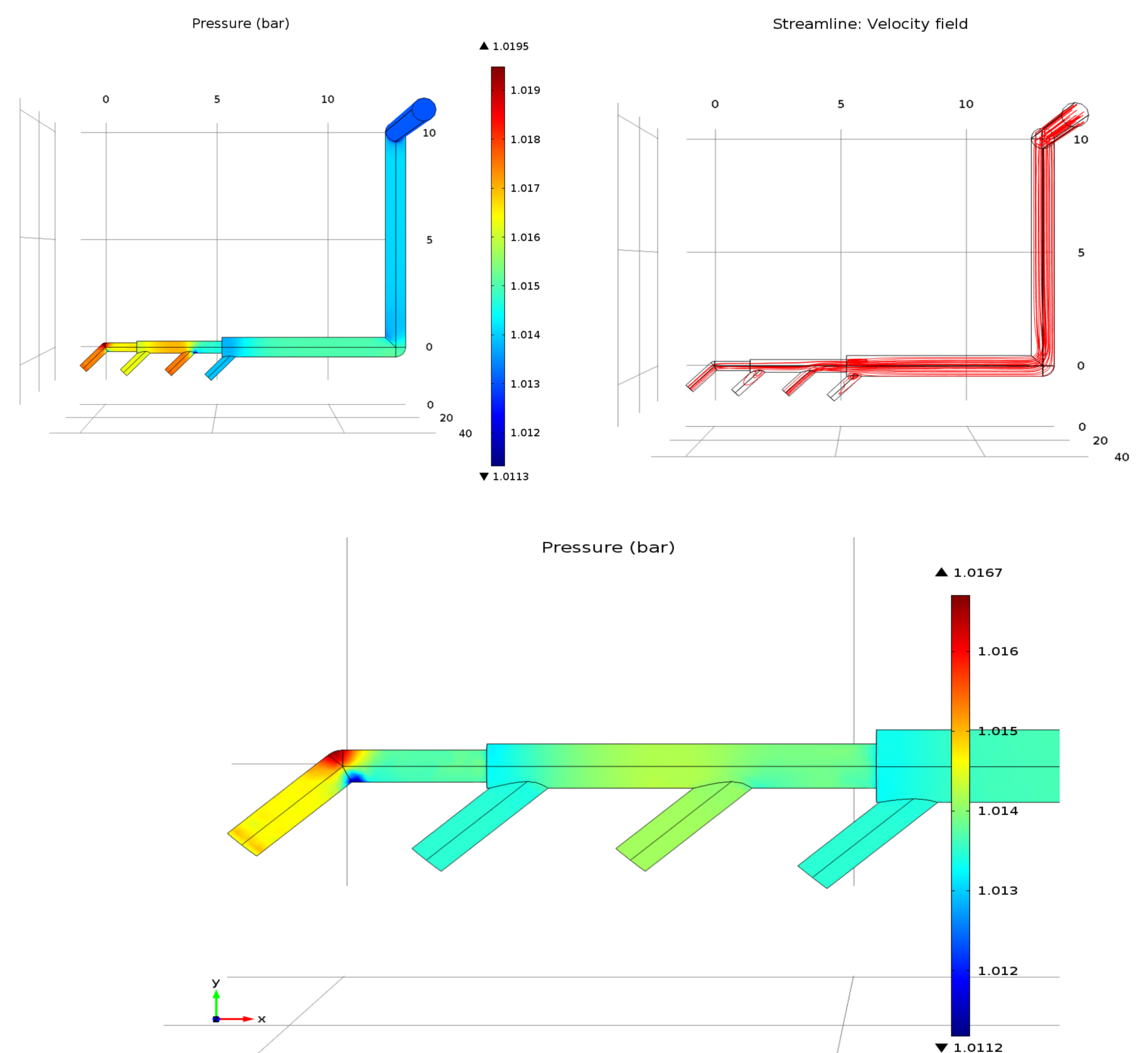


Figure 4. Streamlines and pressure distribution when valves one and three only open

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References:

1. Juha-Pekka Pokki, Markku Hurme, and Juhani Aittamaa, Dynamic simulation of the behavior of pressure relief systems, Computers and Chemical Engineering, 25, 793–798(2001)