

# NALU™ Simulation on a Flow Control Device Completions Design

NALU™ is a multiphase flow dynamics wellbore simulation software proprietary to RGL. The software can conduct multiphase flow dynamics simulation in the near-wellbore regions to mimic various sand control and flow control completions methods. Unlike the commercial software on the market, NALU is based on the fundamental Navier-Stokes Equation with minimal reliance on the empirical correlation. Therefore, the fluctuations between neighboring flow regimes caused by the empirical relationships, as observed in the other commercial wellbore simulators, will be eliminated.

NALU has been utilized as an efficient flow control design tool for various applications including tubing deployed and liner deployed inflow and outflow control devices for both conventional and unconventional operations. Various sand control screens can also be accounted for in the simulation. The key outputs of the model are the radial mass flow rates across the nozzles and pressure drops associated with the specific nozzle distribution. Fig. 1 shows the mass flow rate distribution for the well installed with RGL's tubing deployed devices while Fig. 2 shows its associated pressure distributions in tubing and annulus spaces.

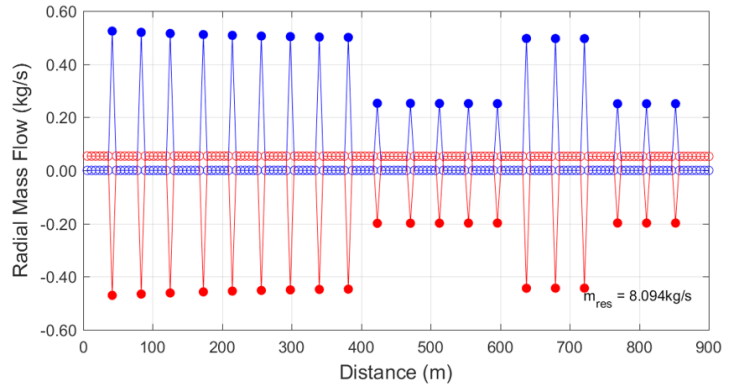


Fig. 1 — Radial mass flow rates for annulus (red) and tubing (blue) for tubing deployed ICDs along a 900 m long well.

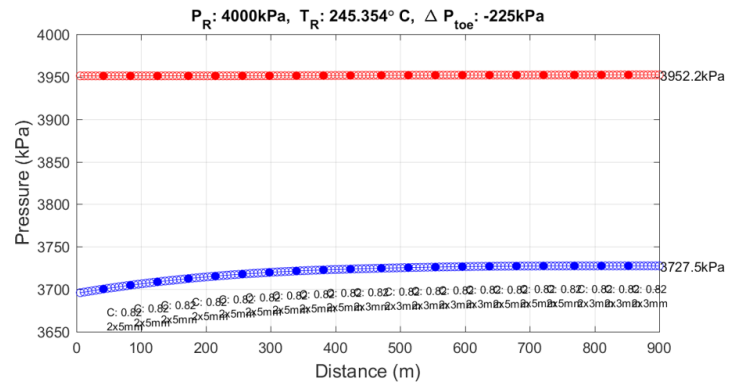


Fig. 2 — Pressure profile in annulus (red) and production tubing (blue) of a well completed with tubing deployed ICDs.