



A Novel Rapid Well Control Methodology in Horizontal Wells

Aim:

To investigate a new well control methodology in horizontal wells that utilises particle (slurry) flow that minimises formation damage.

Methodology:

To utilise Computational Fluid Dynamics (CFD) software to model particulate flow across a drilling bit and annular spaces. The liquid will comprise of a multiphase liquid mixture.

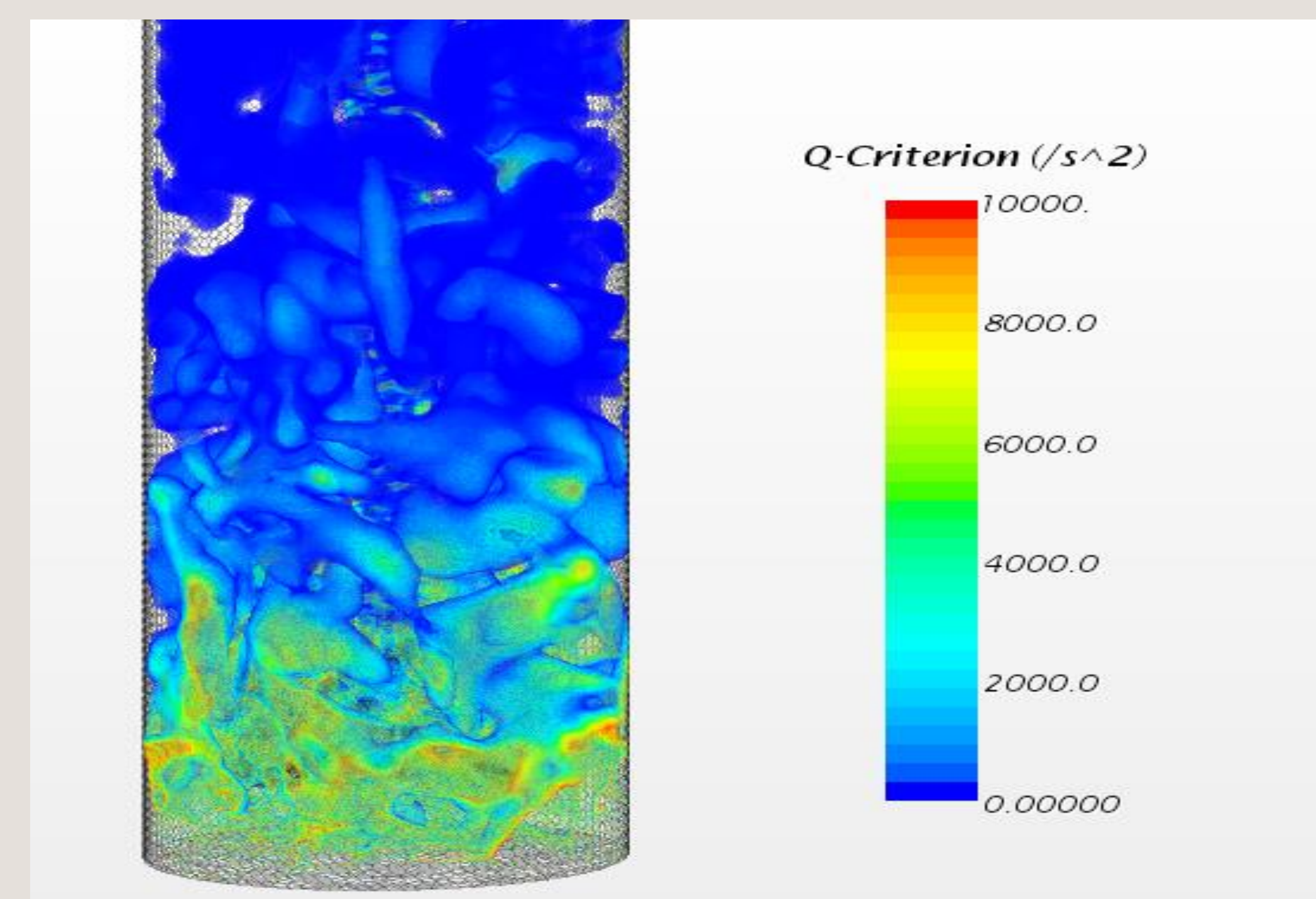
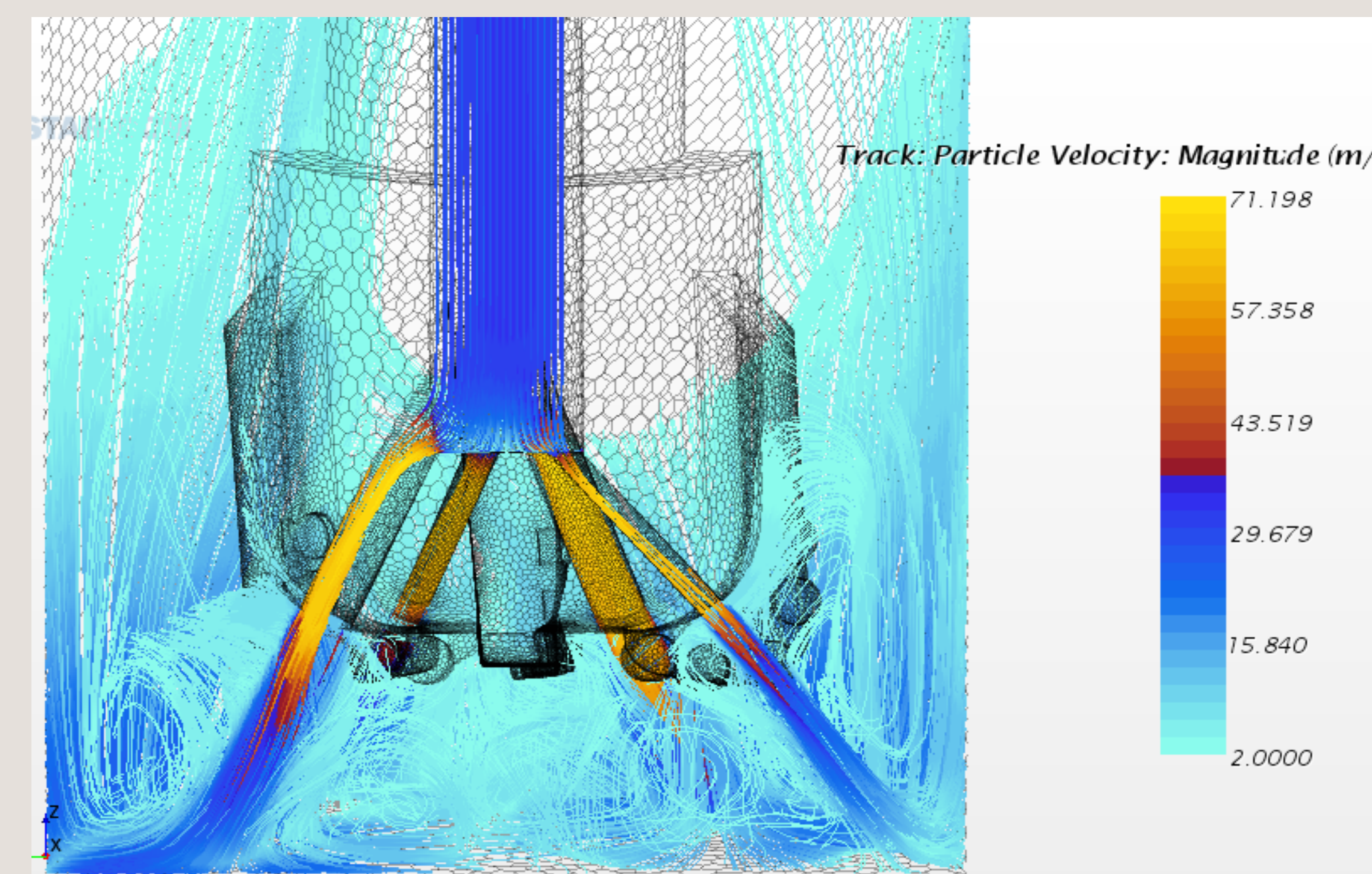
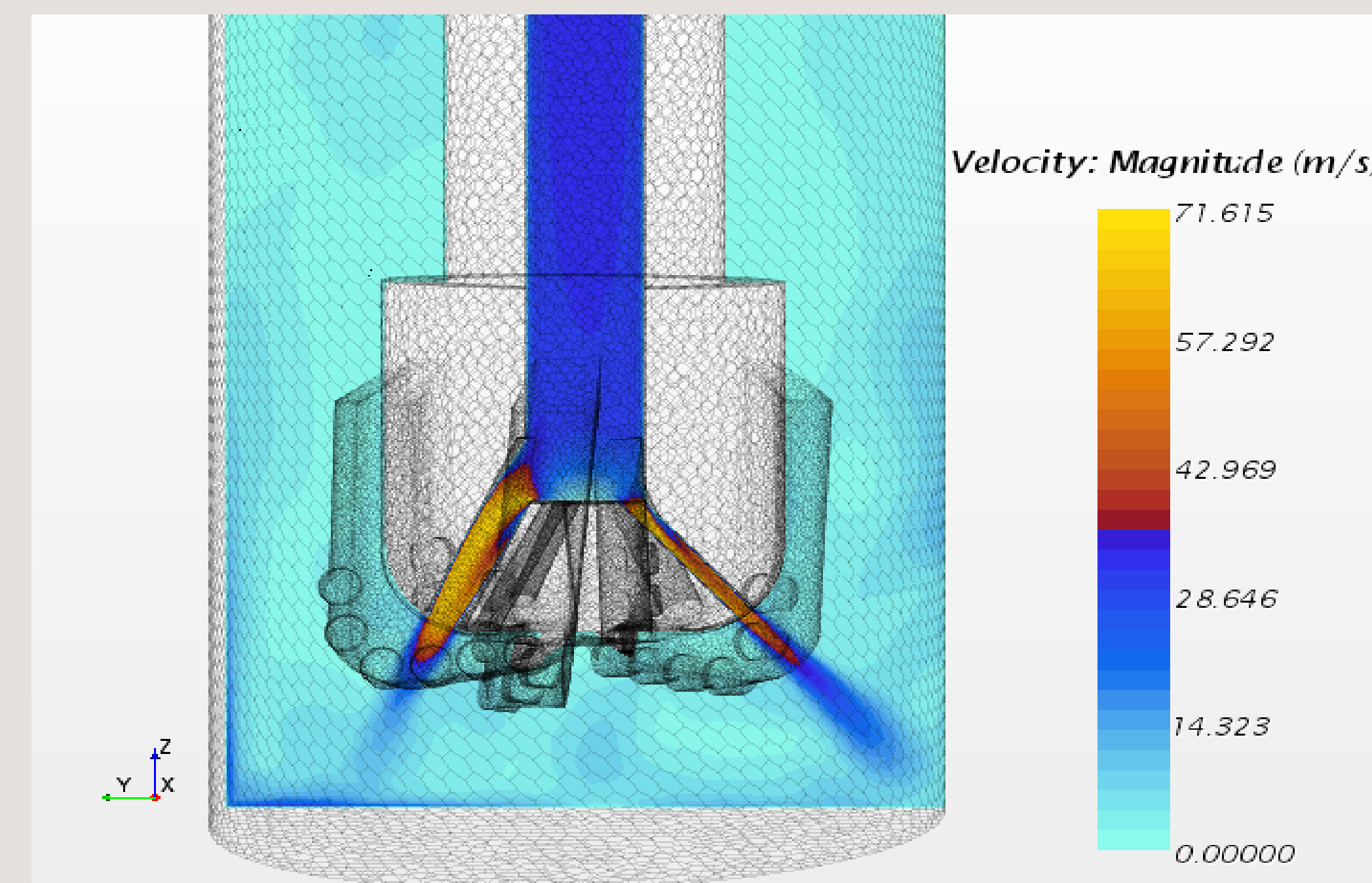
Design and validate the model against published data and experimentally confirm the CFD results on a test rig.

Research Motivation:

International Well Control Forum (IWCF) state that a **major** well control disaster occurs weekly on a global basis. The worst being BP Deepwater Horizon.

The current methodology for well control has not changed in over 40 years.

Outputs:



Results & Discussion

1. Fluid flow model results agree with published fluid flow models for the oil and gas industry.
2. CFD model validated against published slurry (solid – liquid) flow modelling for sand deposition.
3. Particle flow modelling highlights particle separation and potential difficulties in and around the internal parts of the drill bit. Numerical modelling of Stokes number and relaxation times support this outcome.
4. Multiple changes in flow patterns from laminar to turbulent flows across multiple regions increase complexity both mathematically and numerically.

Computational Requirements:

Minimum
Desktop Computer
12 Cores with fast processor
96GB Ram (min 8GB per core)
1TB hard drive

Result: Simulation times 3-5 days. HPC therefore are required to run simulations. Typical simulations run on 24+ cores