



CASE STUDY /

## Ansys + Quaise

Using Ansys Mechanical and Fluent to Understand the Thermodynamics of a Novel Millimeter Wave Drilling Process

*"We are solving the challenging problem of millimeter wave drilling that promises to unlock one of the most important sources of clean energy on the planet. Using Ansys simulation obtained through the Ansys Startup Program, our highly experienced team was able to cut testing time by three months and reduce a testing campaign from ten design iterations to only three. This allowed us to focus more of our engineering resources towards production and supply chain activities."*

**Carlos Araque**  
CEO / Quaise

We are in the early stages of developing millimeter wave drilling technology for deep geothermal heat access, mining and civil construction. Testing at this stage is cost-prohibitive so we use simulation to understand likely operating envelopes before committing to a design. Ansys can help improve the process from a coupled mechanical, thermal, fluid and electromagnetic interaction.

## / CHALLENGES

We are pursuing the development of millimeter wave drilling. This is a very new product in its early stages of development, so before we commit to a design, we are trying to understand the technical program of transferring millimeter waves over long distances via overmoded waveguides, interaction of those waves with heterogenous igneous rocks, phase changes and multiphase mass transport over high thermal and pressure gradients. These are all very difficult to control and expensive to test in a real-world experiment, so we use simulation to peek into the process.

## / TECHNOLOGY USED

- Ansys Fluent
- Ansys Mechanical

## / ENGINEERING SOLUTION

- Ansys Fluent is used to simulate turbulent flow with particle and heat transport.
- Ansys Workbench is used to explore many design iterations.
- Ansys Mechanical is used to understand the thermal effects and limits of downhole equipment.
- Ansys CFD Post is used to look at all field variables of interest, like pressure, temperature, flow velocity, strain, stress and particle trajectories.

## / BENEFITS

By using simulation, we were able to do something that would have been otherwise impractical to do through real-world testing. Simulation helped us understand the process better so we know what to expect during future testing. Through advanced modeling and simulation, we saved three months of testing time and reduced a testing campaign from ten iterations to only three, allowing us to focus some of our engineering resources towards production and supply chain activities.

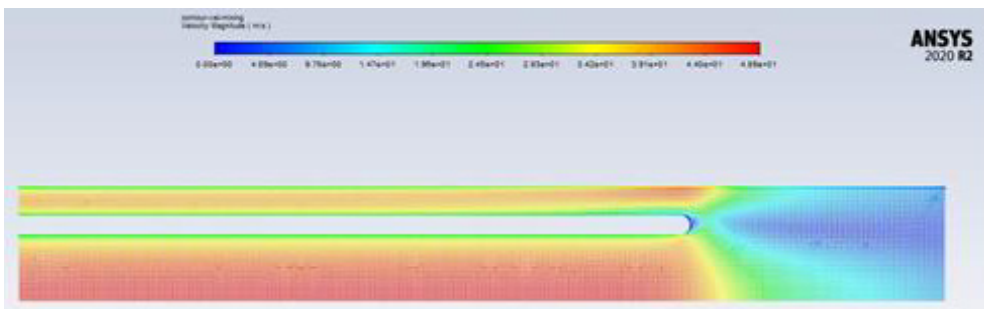


Figure 1. Steady axisymmetric velocity field at the bottom of the millimeter wave drill string

## / COMPANY DESCRIPTION

Founded in 2018, Quaise is an energy company that is pursuing the development and commercialization of millimeter wave drilling technology for deep geothermal heat access, mining and civil construction. Their hybrid deep drilling method allows drilling at depths beyond what can be accomplished today with conventional drilling. Quaise's technology creates a promising future for the transition of clean energy globally.

### ANSYS, Inc.

Southpointe  
2600 Ansys Drive  
Canonsburg, PA 15317  
U.S.A.  
724.746.3304  
ansysinfo@ansys.com

©2021 Ansys, Inc.  
All Rights Reserved.

[ansys.com](https://www.ansys.com)