

Simulation of a Novel Clean Hydrogen Production Process using Virtual Reactor's New Vapor-Liquid-Solid Capabilities

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Ally Power

Founded in 2019

- Walt Joesph Alfred – Inventor of Hydrogen Electric Refueling Station (H.E.R.S)

One of the only clean hydrogen production technologies that is a producer of electricity

- Produces both hydrogen and heat via a chemical reaction process

Focused on creating circular economies while decarbonizing hard to abate industries:

- Concrete
- Cement
- Steel
- Aluminum



Walt Joesph Alfred
Founder & CEO



Ahmed Mahmoud
COO & Board Member



Alexander Clayton
VP of Engineering



Zaryab Choudry
Board Member



Jeff Malcolm
Board Member



Dana White
CFO & Board Member



Travis "Ed" Leonard
VP of BD APAC



Khalifa Tamer
VP of BD MENA

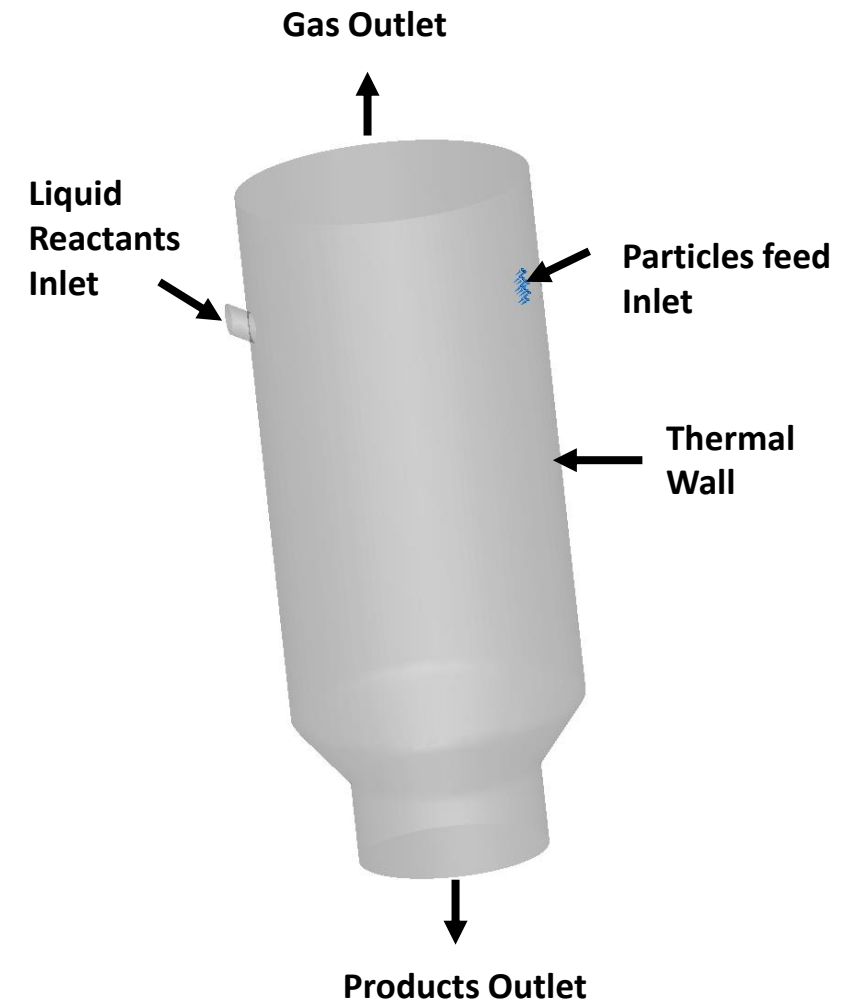
Baseline Simulation

Model setup

- Geometry, inlets, outlets based on Ally Power's inputs
- Multiphase reaction implemented
 - $Liquid\ Reactant + H_2O + Solid\ Reactant \Rightarrow Liquid\ Products + H_2$
- H_2 in vapor/liquid equilibrium between phases

New modeling features required

- Multiple liquid species (22.0)
- Liquid reactions (22.0)
- Compressible bubbles (22.1)
- Gas absorption model (22.1)
- Bubble coalescence and breakup (23.1)



Baseline Reactor Design

Example Baseline Results

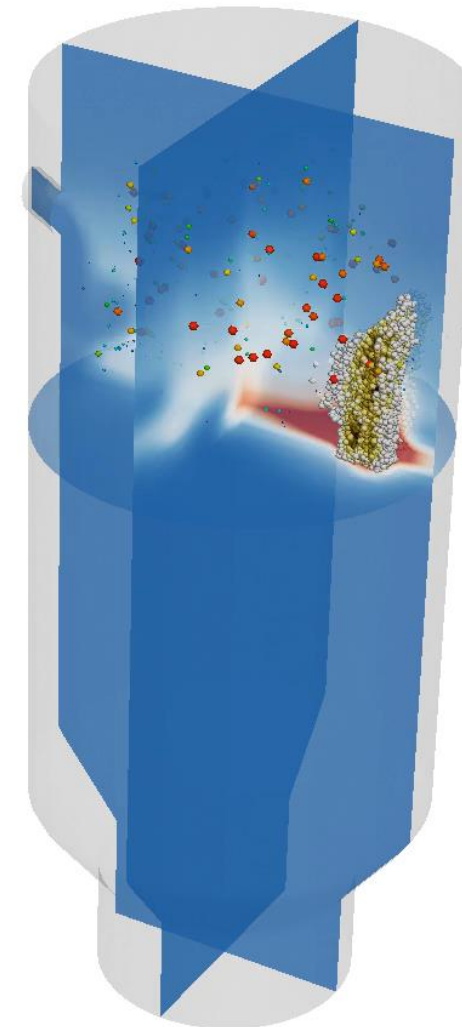
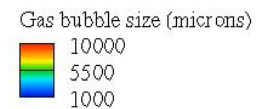
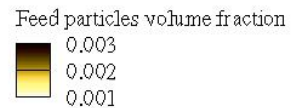
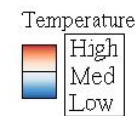
Virtual Reactor simulation demonstrated

- Product formation
- Gas production
- Heat generation

Baseline design challenges identified

- Uneven heating – Hot spots
- Reactants consumption skewed towards one side of the reactor vessel
- Potential for channeling of the feed to the bottom

Baseline Design

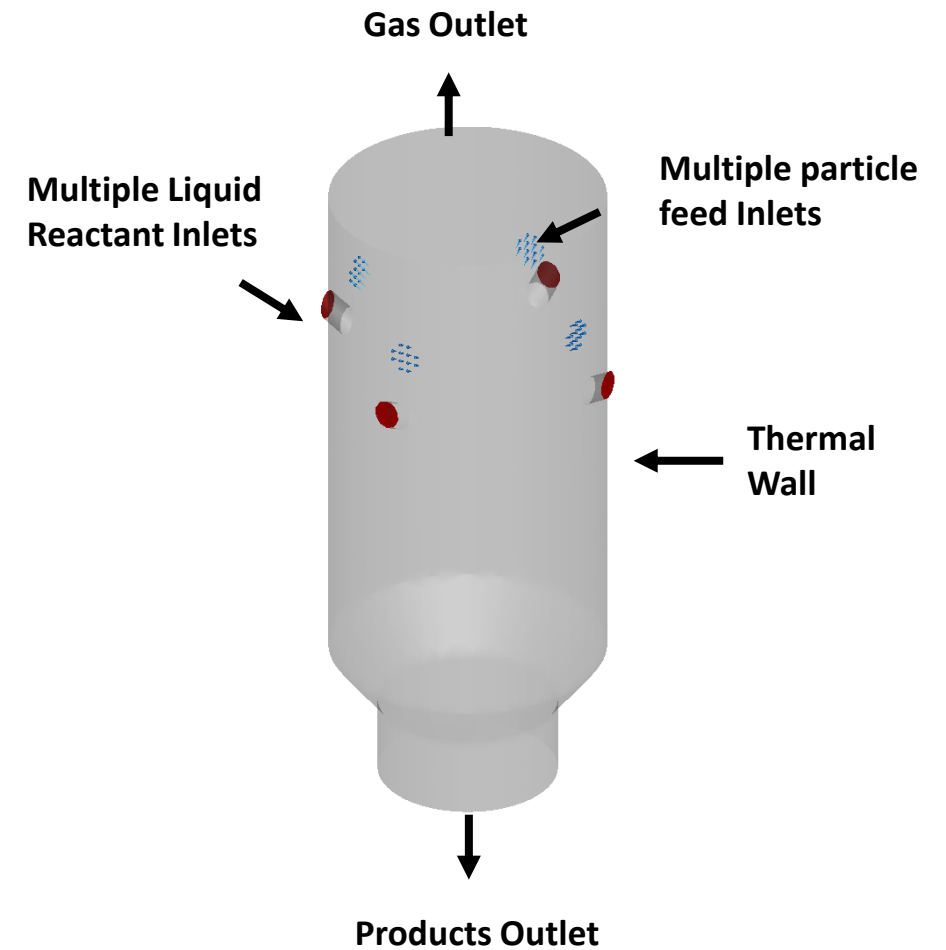


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Virtual Testing of Modified Design

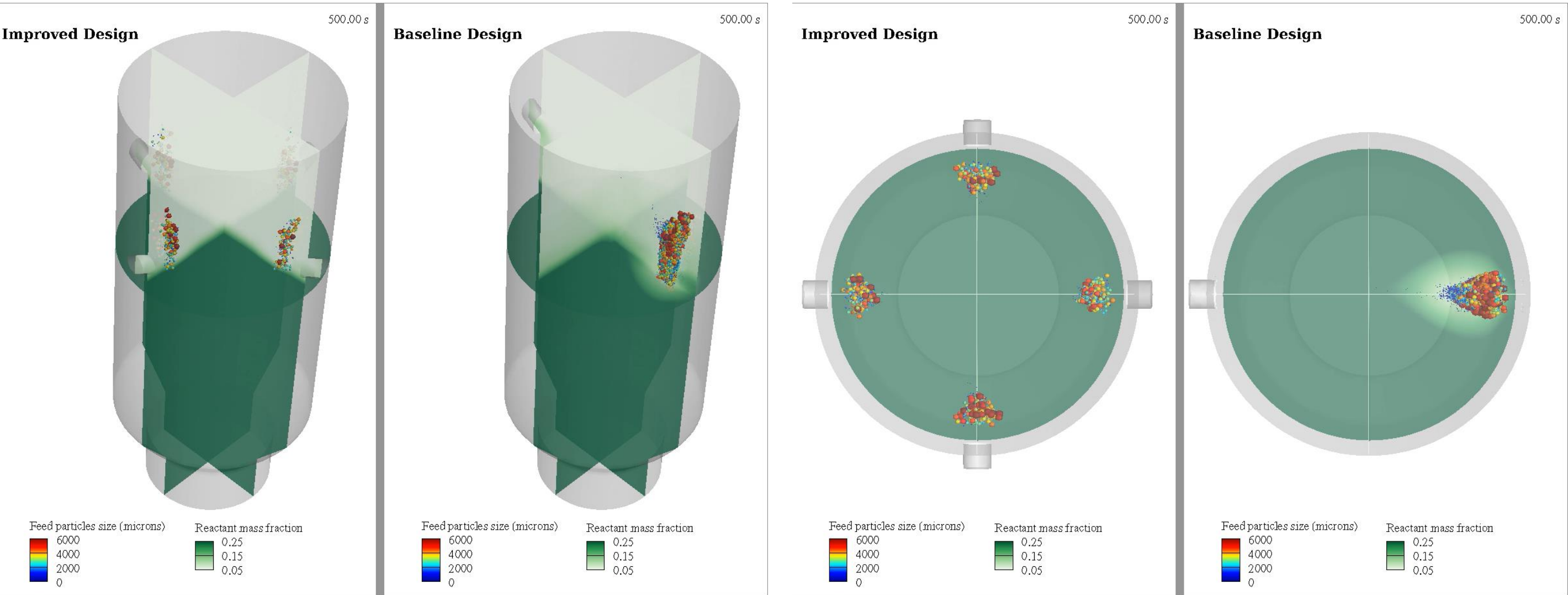
An alternate design was tested based on insights obtained from the baseline model

- Multiple reactant fluid inlets, 90 degrees apart
- Inlets moved down to the reactant line
- Multiple solid particle feed inlets above the reactant inlets

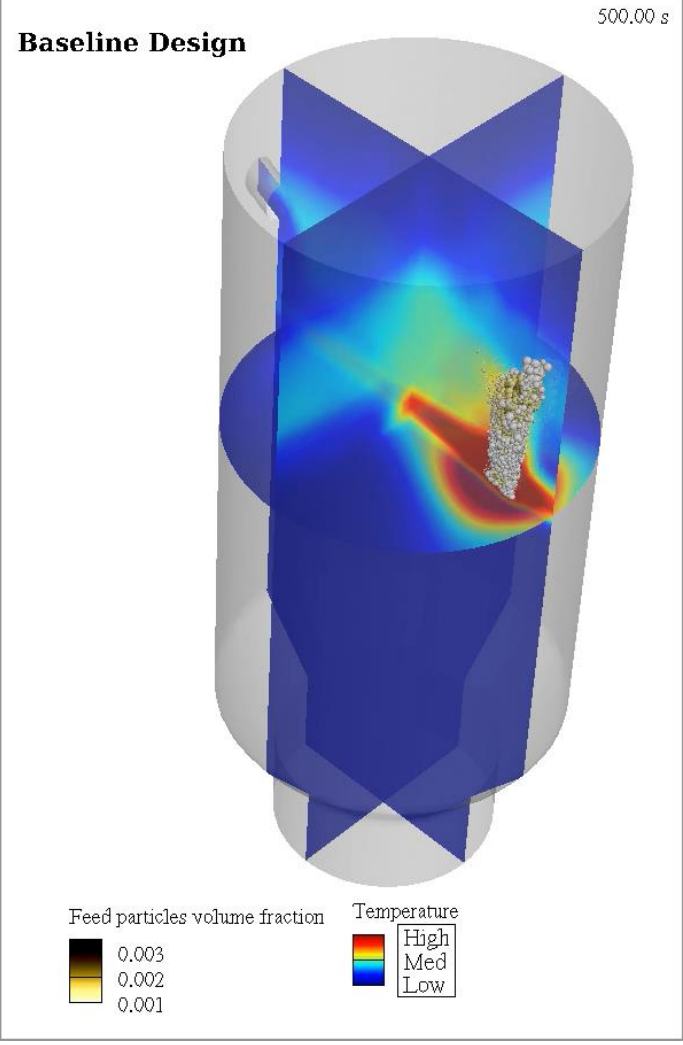
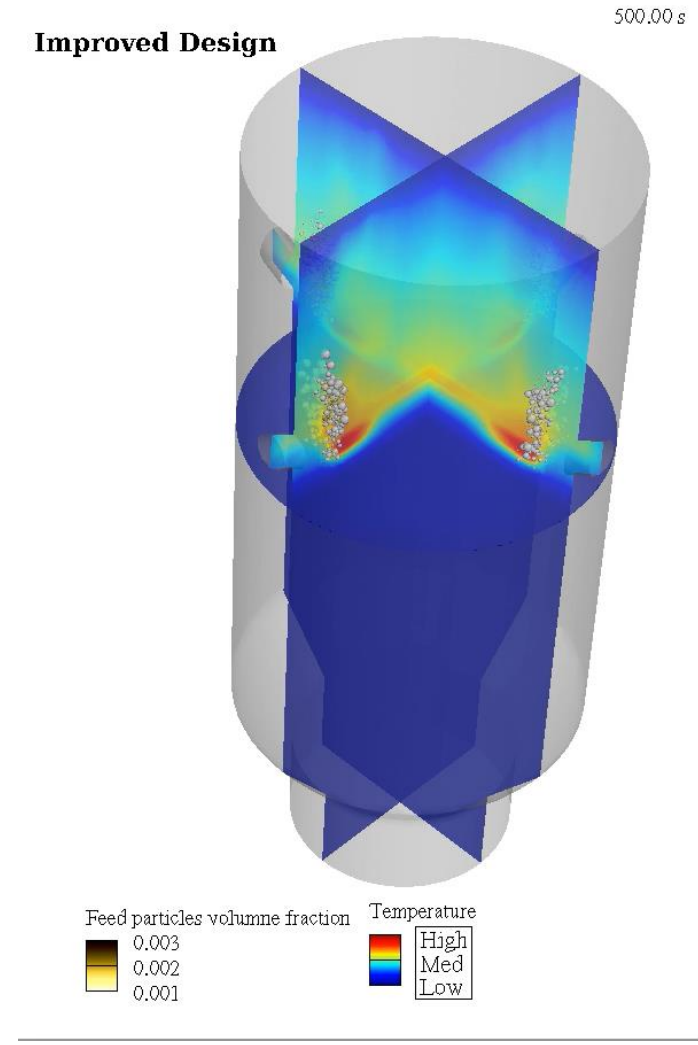
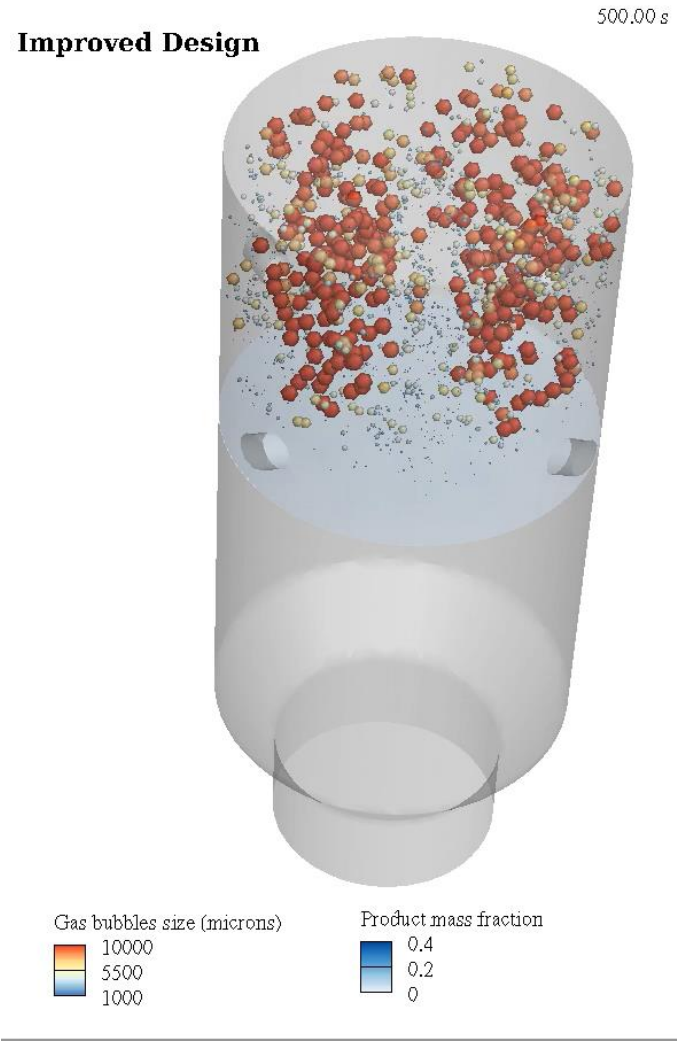


Modified Reactor Design

Virtual Testing Results – Reactant Mixing



Virtual Testing Results – Products and Heat Generation



Conclusions and Path Forward

Short term:

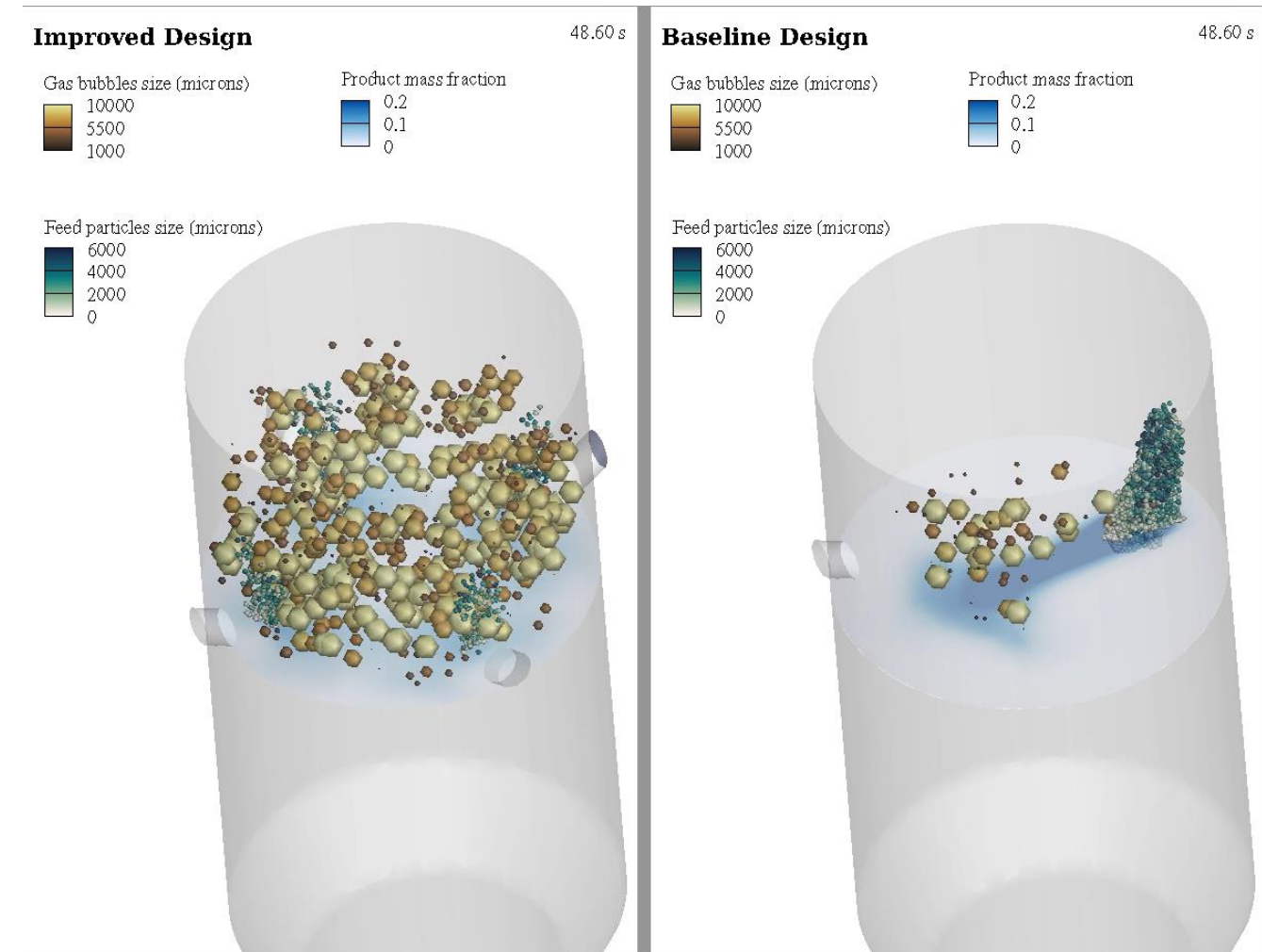
- Decreased commercialization timeline by 50%
- Cost savings of \$500,000
- Increased optics for internal & external engineering teams to optimize design and process engineering

Medium Term:

- Proof all new systems design via Virtual Reactor prior to build out

Long Term:

- Utilize Barracuda Virtual Reactor Software to optimize and develop new systems to deploy in Ally Power's HERS



Thank You and Questions

