

Non-Traditional Thermal Reactor Development for Gasification

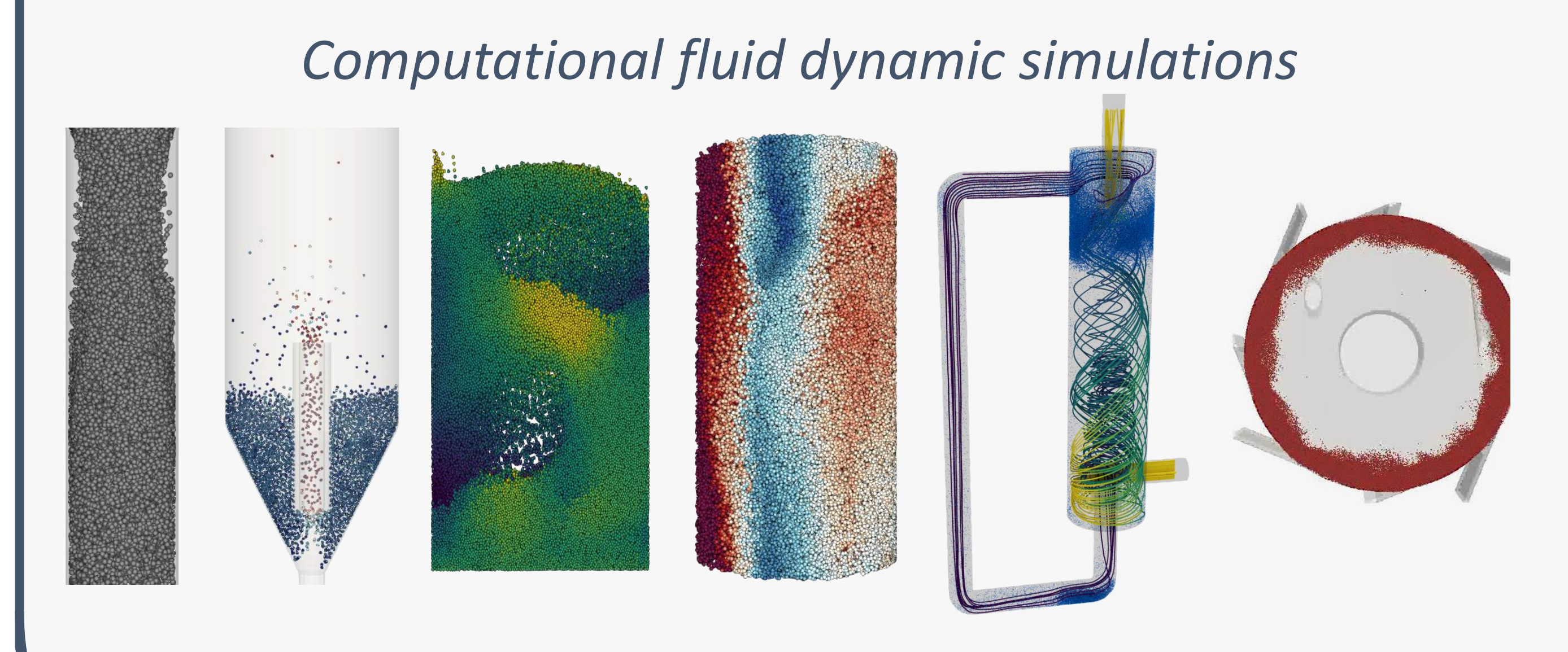
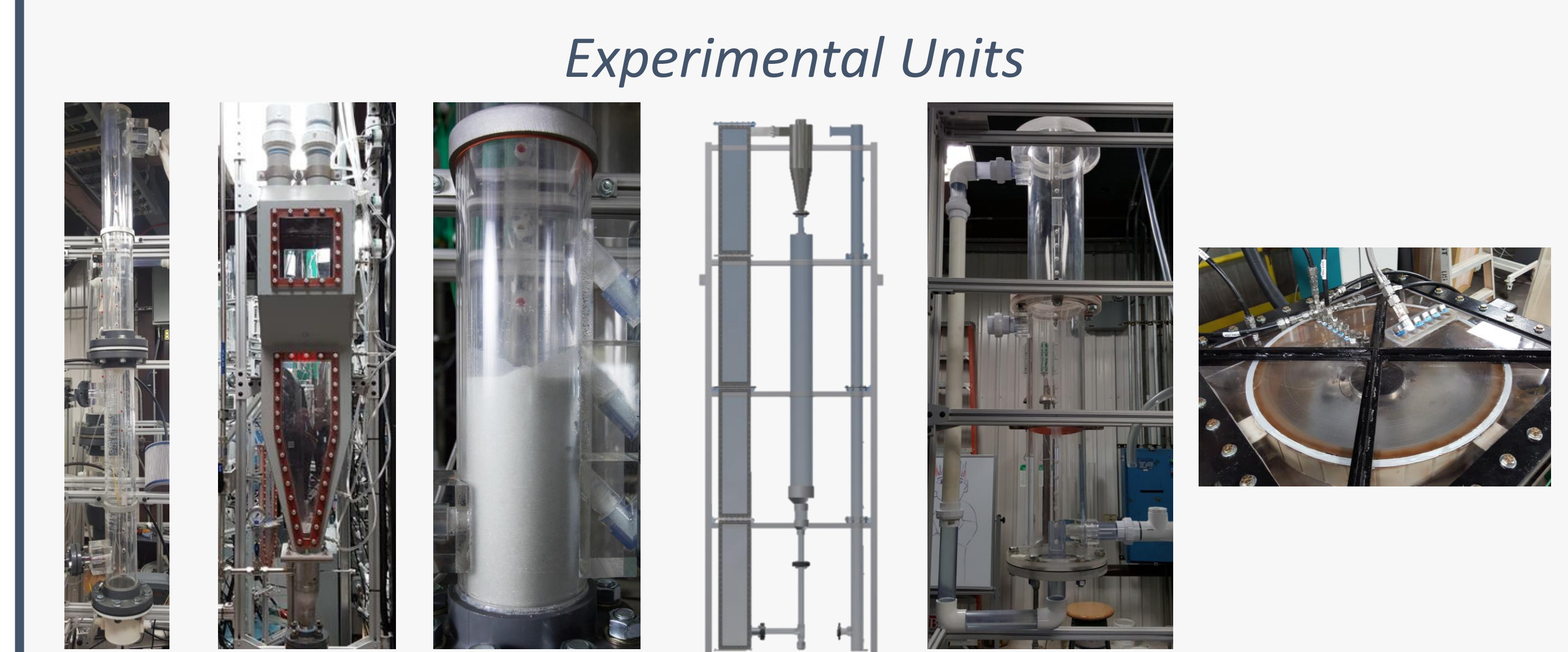
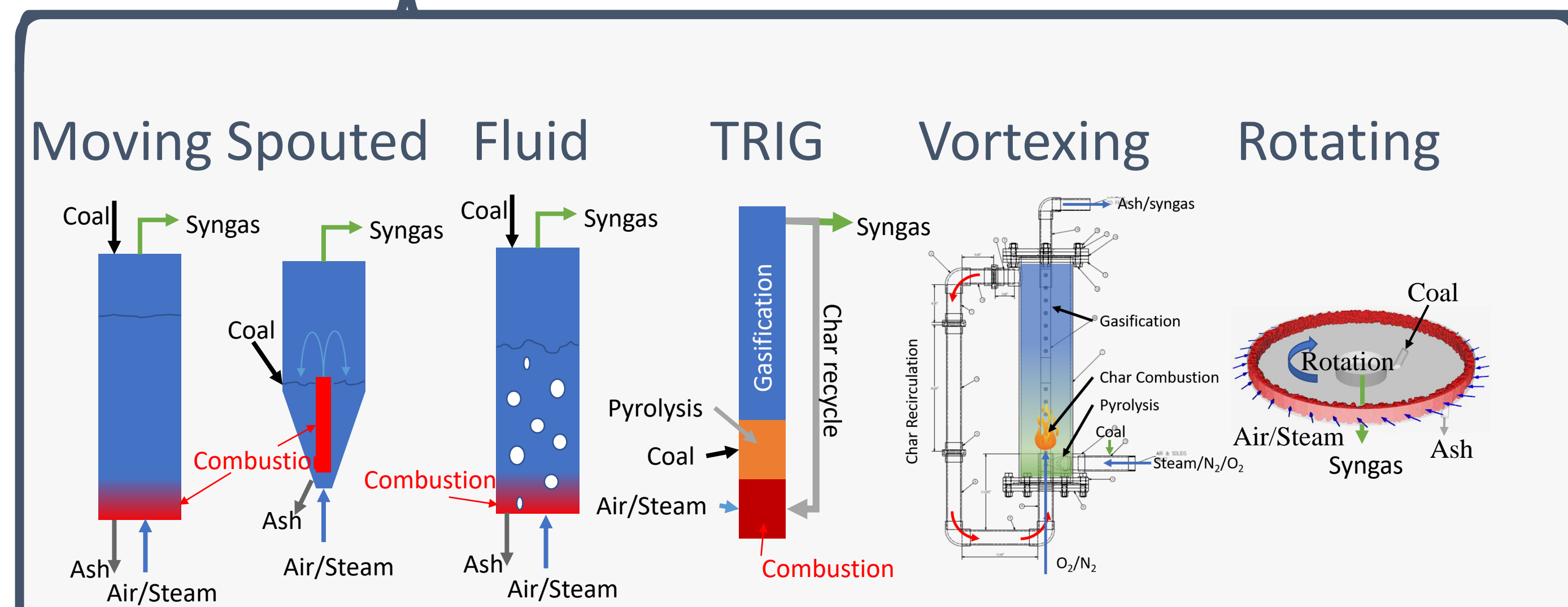
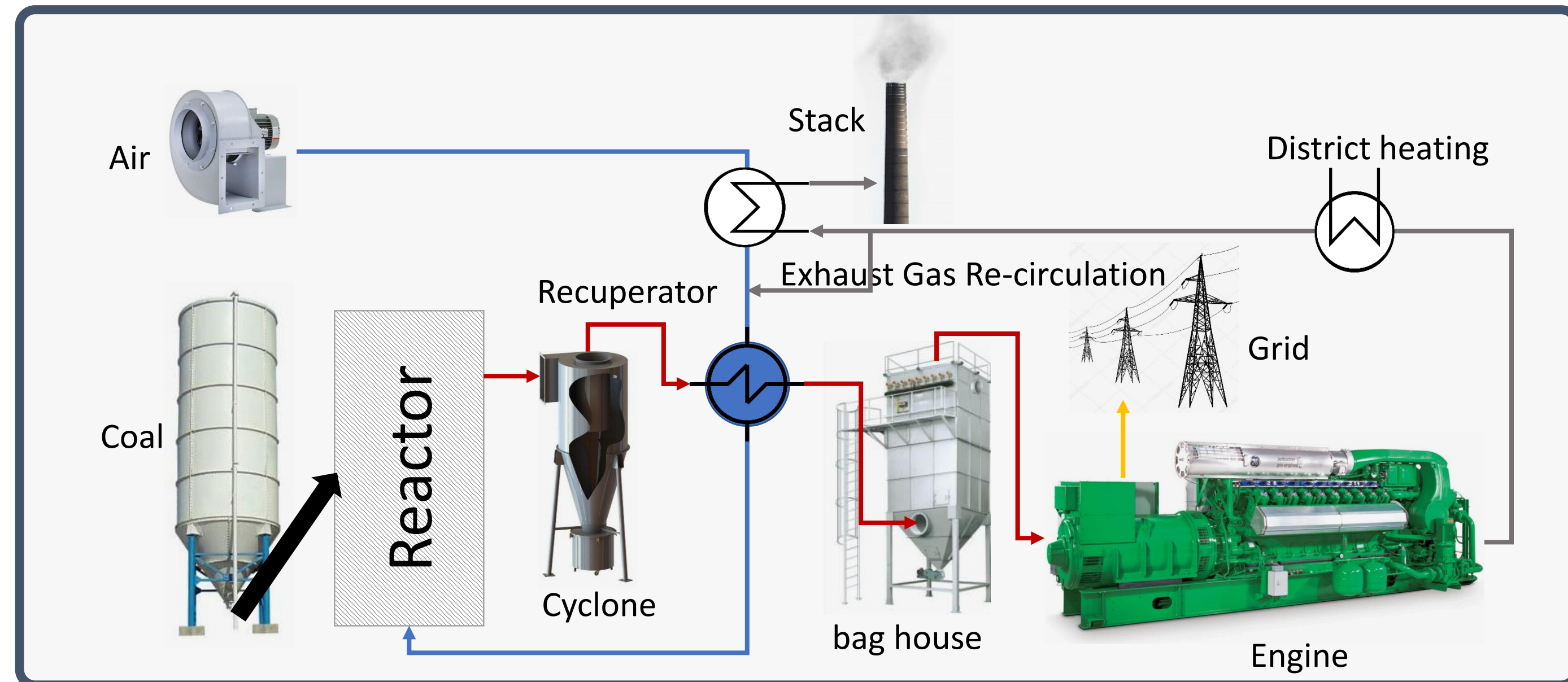
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Objective Develop an optimized 1MW reactor (gasifier) capable of converting coal into syngas at thermal efficiency greater than 60% and a volumetric heat flux greater than $0.5 \text{ MW}_{th}/\text{ft}^3$

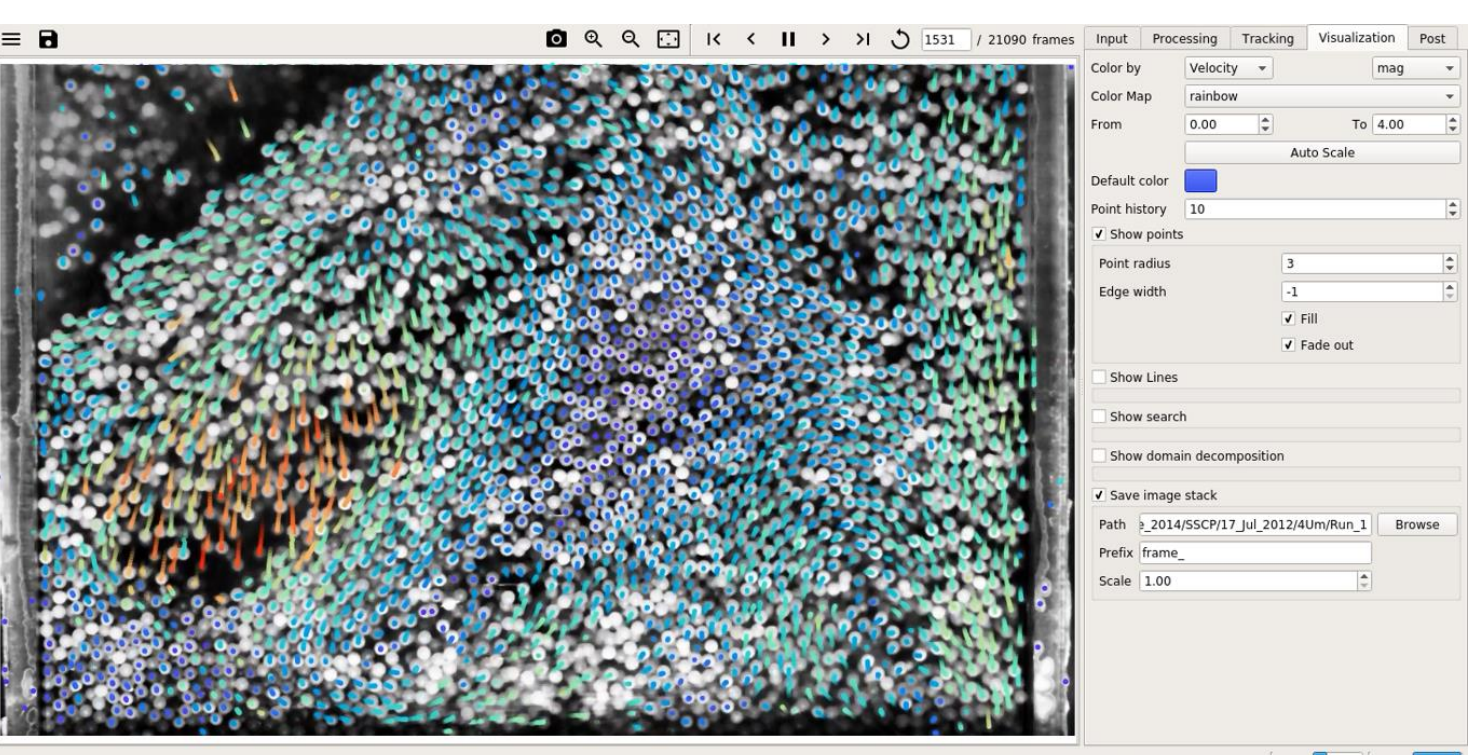
- Approach**
1. Develop a screening tool (mass and energy balance) to evaluate potential reactors
 2. Construct cold flow experimental units to collect validation data
 3. Develop computational (CFD) models of the potential reactors and “calibrate” to experimental units
 4. Use CFD models to evaluate coal gasification performance.
 5. Pick the most promising reactor and construct a hot reacting unit.

- Results**
- Screening tool (mass and energy balance) has indicated:
 - Rotating fluid bed require too much gas, syngas is not combustible in an IC engine
 - Conventional riser can not meet target volumetric heat flux
 - Vortexing circulating fluid bed operating map completed with measured particle velocities.
 - Preliminary conventional riser regime map completed
 - Spouted bed regime map completed with fountain height correlations developed.

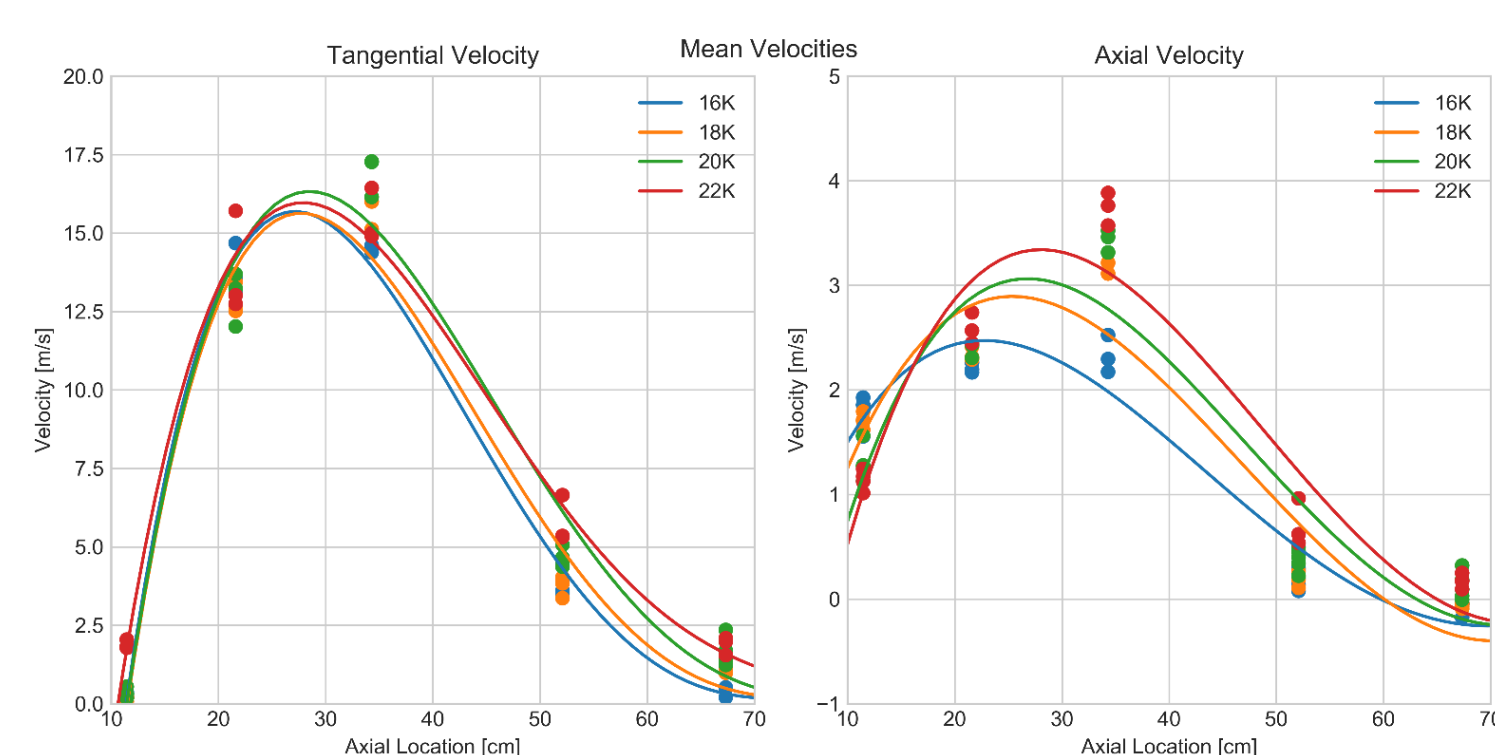
- Products**
- Tracker – open source application for particle tracking velocimetry.
 - High quality datasets – pressure, particle velocity, fiber optic, and ECVT measurements
 - Correlations – engineering relationships to predict design parameters (fountain height, flow regimes)
 - Publications



Best Reactor?



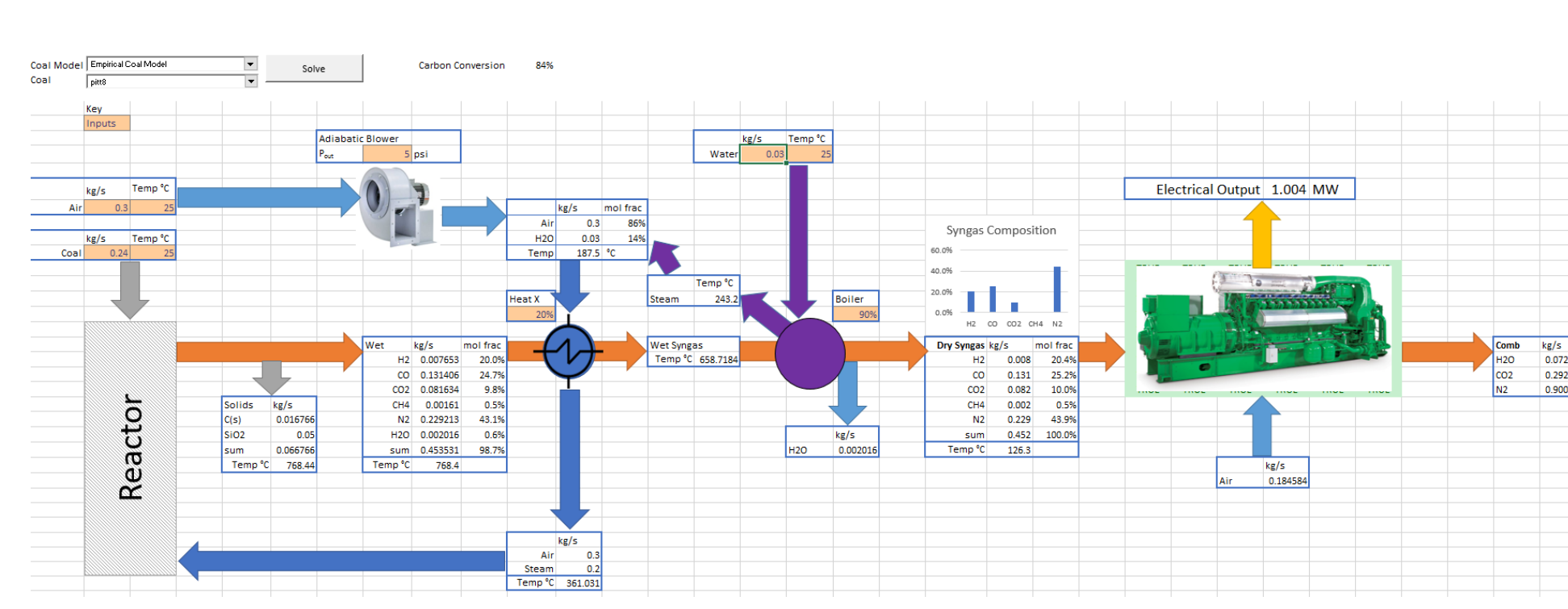
Tracker – Open source particle tracking application



Vortexing CFB particle velocity profiles



Custom manufactured fiberoptic probe



Screening tool (mass and energy balance)