Progress to date

- Enabled dynamic load-balancing strategies that account for particle density and a dual-grid approach that allows different domain decompositions for the mesh data and particle data.
- Replaced the SIMPLE algorithm for fluid flow with a modern projection method and explored two spatial discretization alternatives. The new projection formulation demonstrates a factor of four speed-up relative to the SIMPLE method in a weak scaling study from 1 to 4,096 cores.
- Implemented AMReX embedded boundary capability and local mesh refinement at and near solid boundaries and successfully demonstrated coupled fluid-particle flows in basic non-rectangular geometries.

Using NETL’s 50 kW CLR as an exemplar, MFIX-Exa is developing an exascale application that can be used in the design process of emerging carbon capture reactors to reduce technology development costs and ensure that scaled-up reactors meet performance targets.