Energy Saving and Emission Reduction for Petroleum Coke Calcination: 2D & 3D Rotary Kiln Study

2D Model:

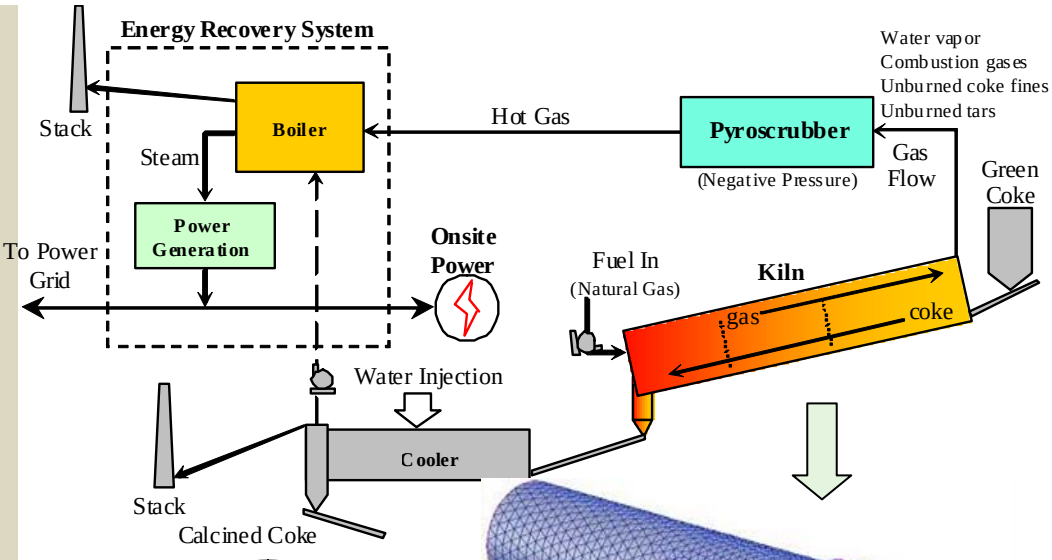
Rotational Transient Study of Brick Thermal Properties

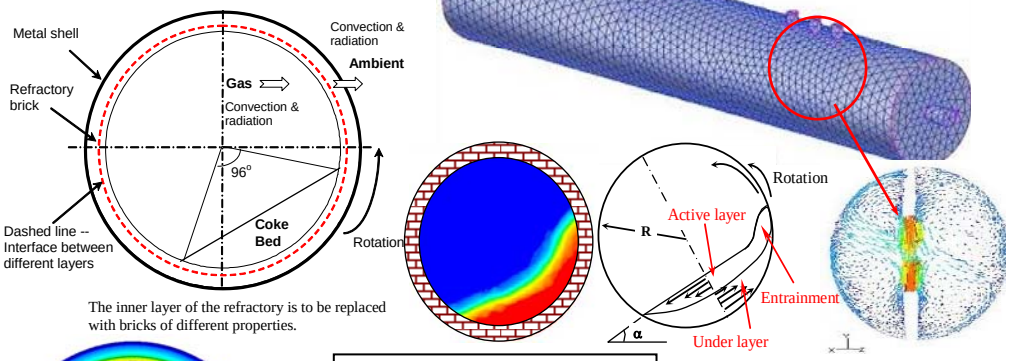
- **The postulation**: Bricks with higher thermal capacity could store more thermal energy during the period in contact with the hot gas and would release more heat to the cock bed when the bricks rotate to the position in contact with the coke bed.
- **Results**: Against the postulation, higher thermal capacity of brick actually reduces temperature gradient and hence, decreases heat transfer from brick to coke bed.

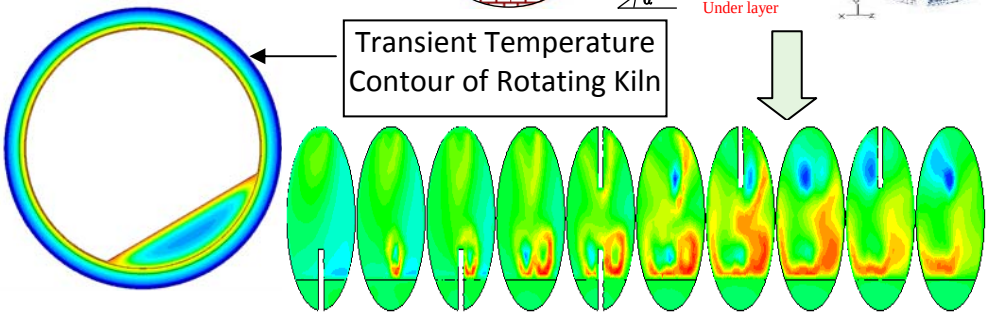
3D Model:

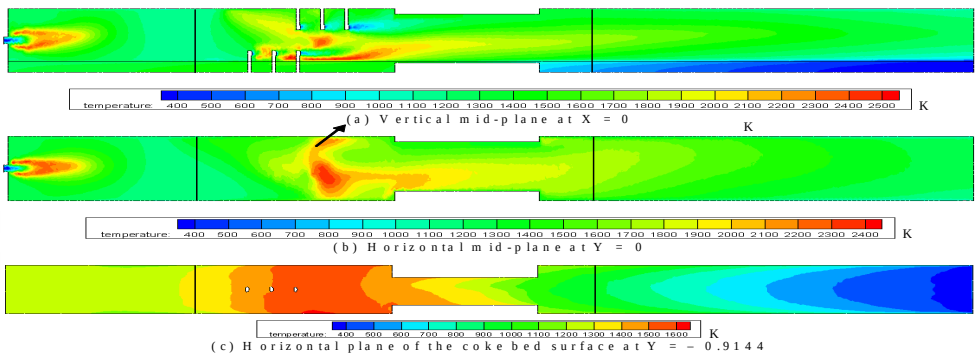
Rotary Kiln Simulation with Devolatization and Combustion

- **Overall objectives**
  - ✓ Identify the means of increasing energy efficiency
  - ✓ Reduce natural gas consumption
- **Approach:** Numerically simulate thermal-flow and combustion process inside a rotary calcination kiln and study the effect of following operational parameters:
  - ✓ Rotational angles
  - ✓ Tertiary air injection angles
  - ✓ Discharge end flow control
  - ✓ Coke bed devolatilization conditions









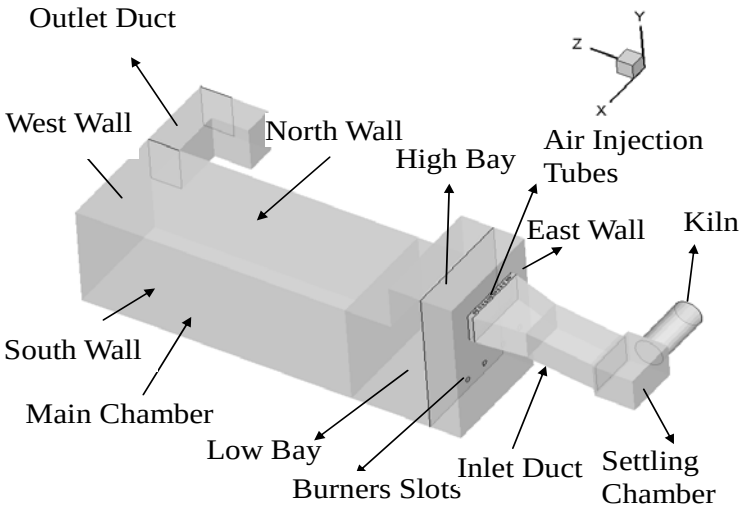
UNIVERSITY of NEW ORLEANS

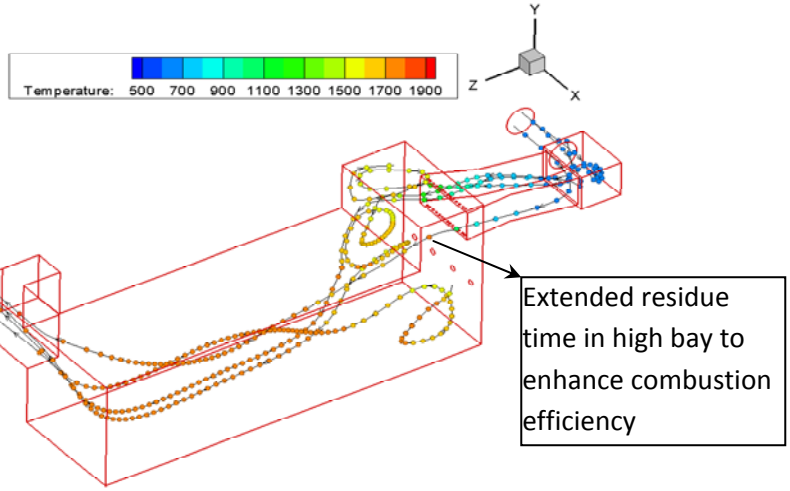
Energy Conversion & Conservation Center

Energy Saving and Emission Reduction for Petroleum Coke Calcination: Pyroscrubber Study

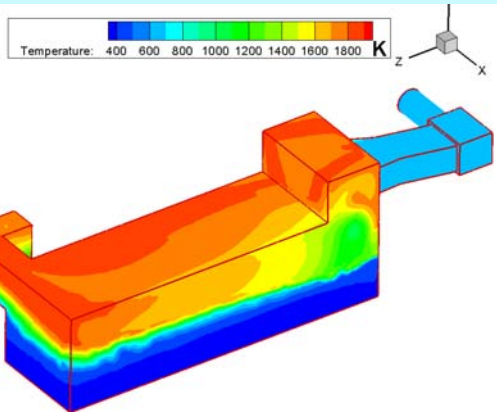
3D Pyroscrubber Study Objectives:

- **Develop a numerical model of the pyroscrubber that simulates the thermal-flow and combustion process.**
- **Investigate flow pattern, temperature distribution, combustion process, and emission information inside the pyroscrubber.**
- **Study the effect of different amounts of air injection to reduce emissions.**
- **Simulate and study the effect of introducing a multistage burning strategy on emission control and energy output.**



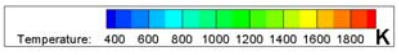


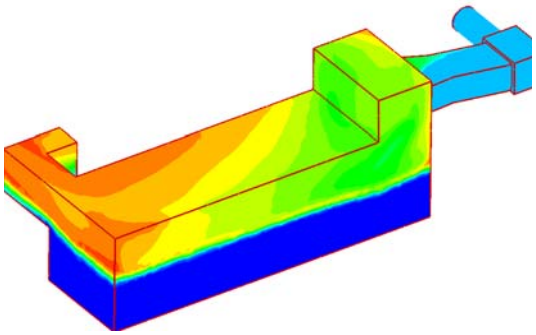
Coke particle trace inside the pyroscrubber



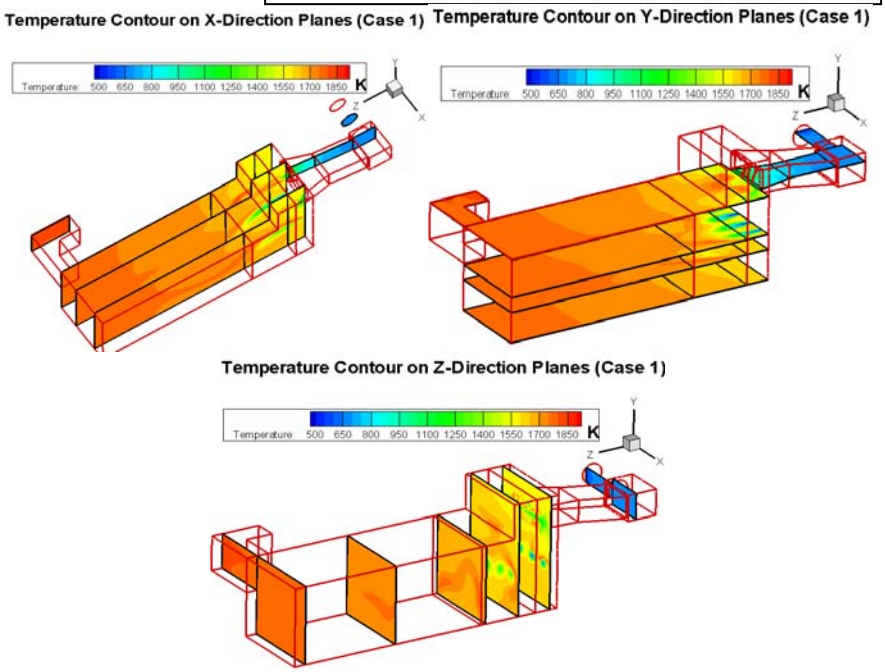
Partial doors open + 100% air injection

Ventilation doors opened to draw air for combustion





All doors open without air injection



Baseline Case (100% stoichiometric air)