Evaluation of Fuel Pre-Processing For Lean Premix Combustion

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UTSR Fellowship

with

GE Energy

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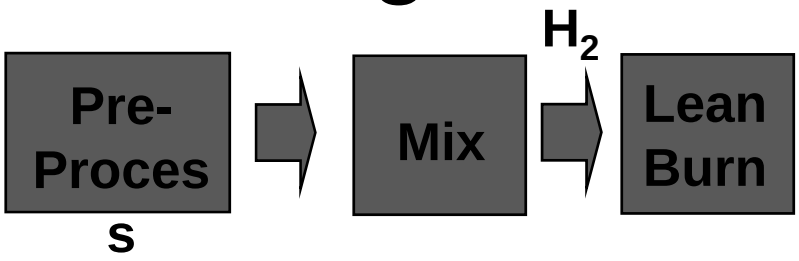
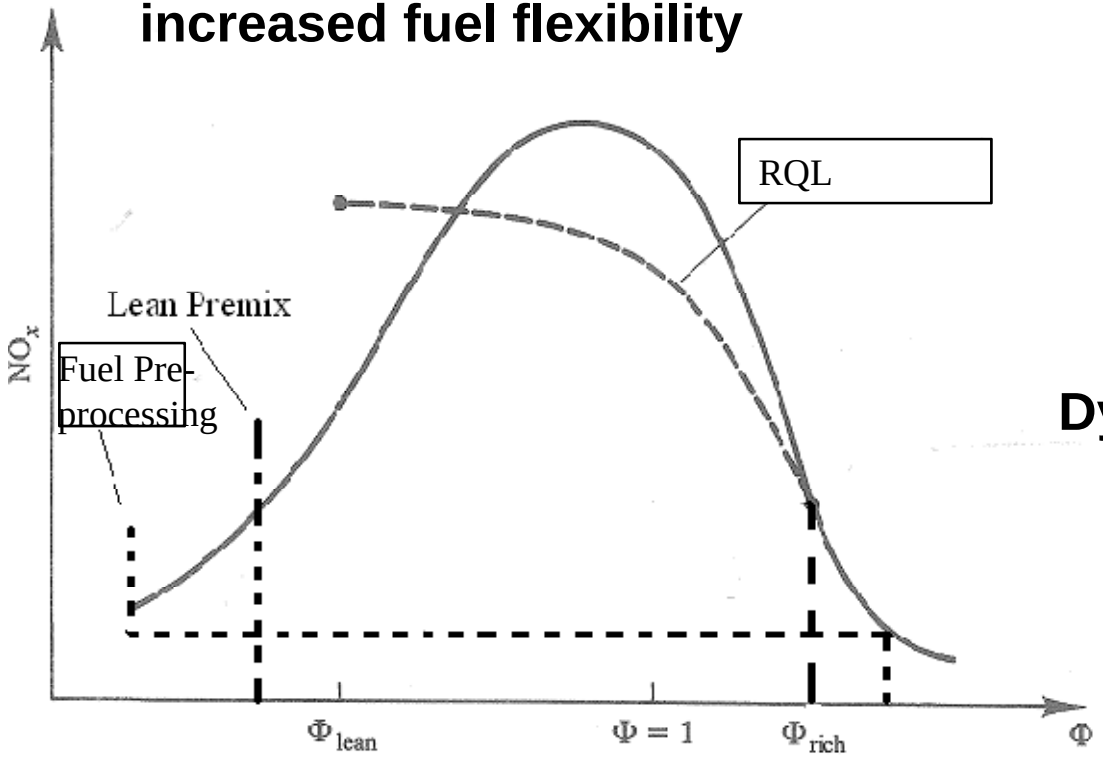
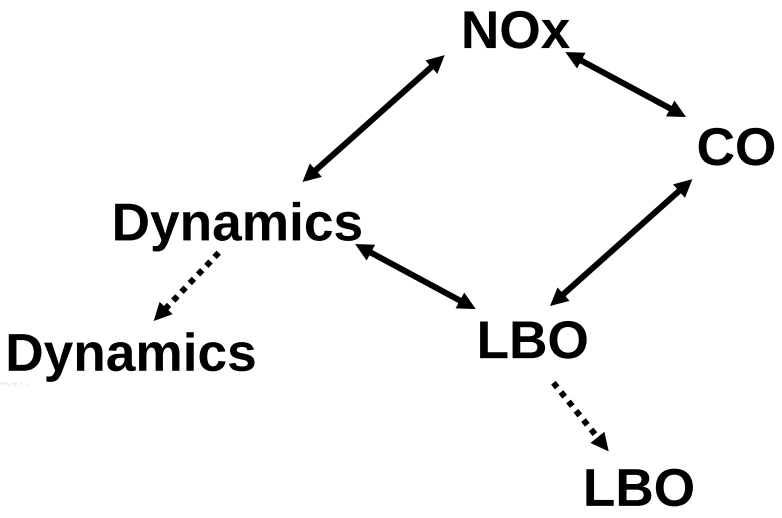
Fuel Preprocessing

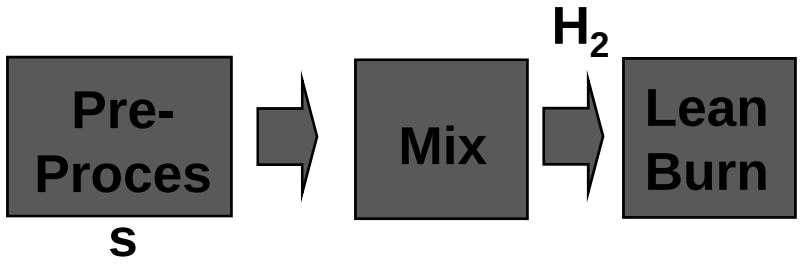


Goal: Increase lean combustor operating range leading to potentially increased turn down, lowered emissions and increased fuel flexibility





Fuel Preprocessors



Steam Reformation

50% H_2

Heat Exchanger

Catalyst

Steam

Catalytic Partial Oxidation

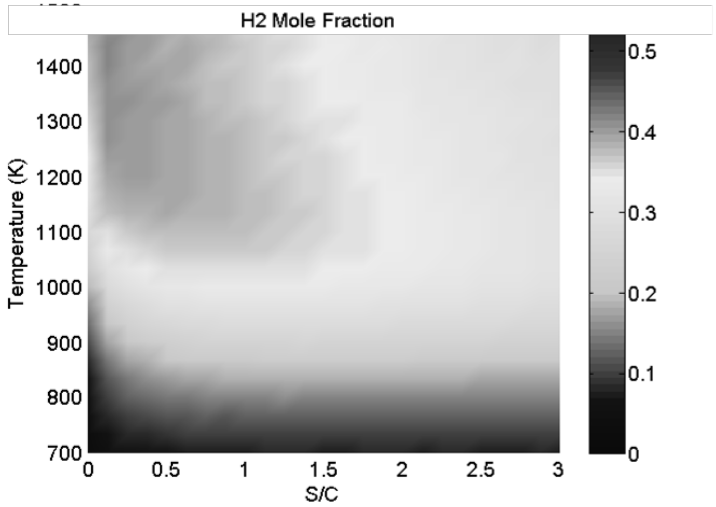
35% H_2

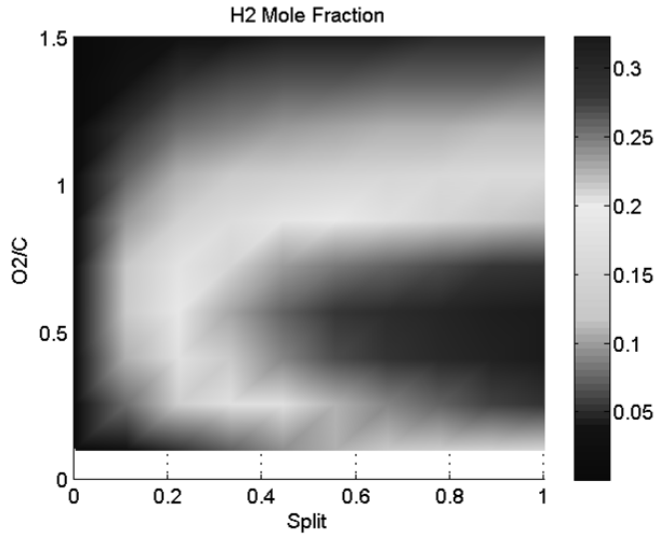
Heat Exchanger

Catalyst

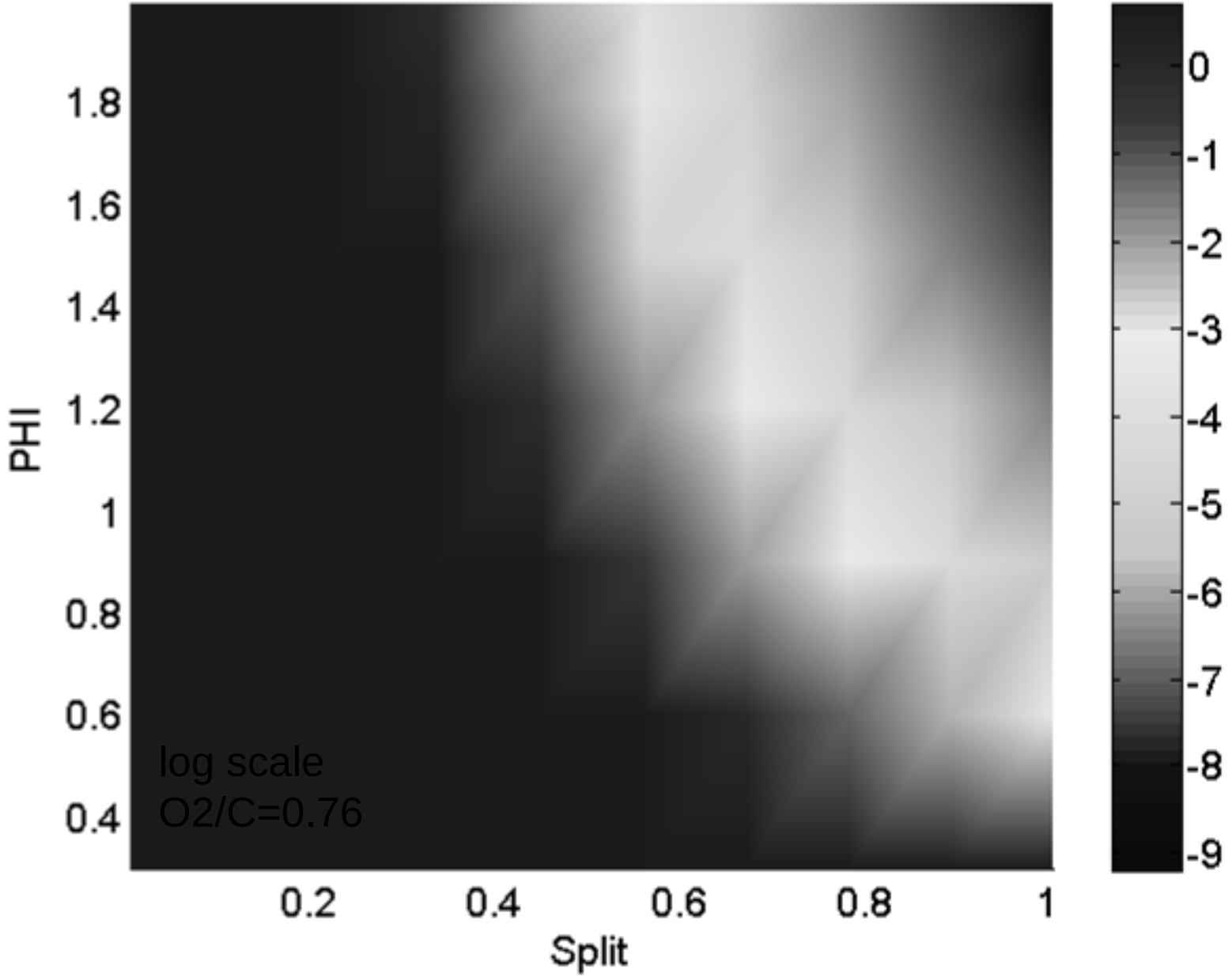
Staged Combustion

35% H_2



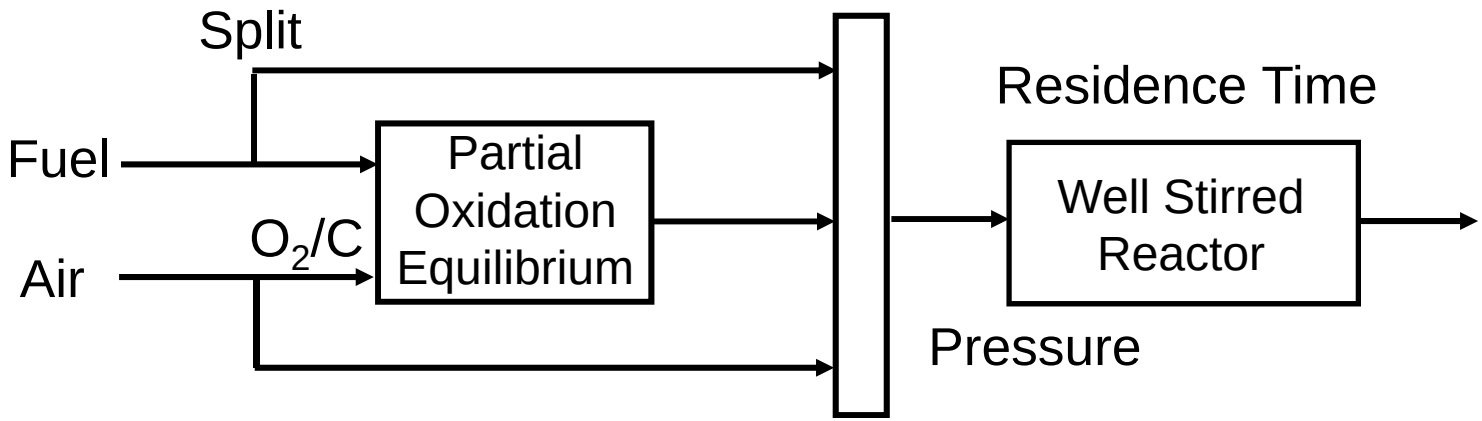


Lean Premix Auto-Ignition Time



Lean Blowout Model

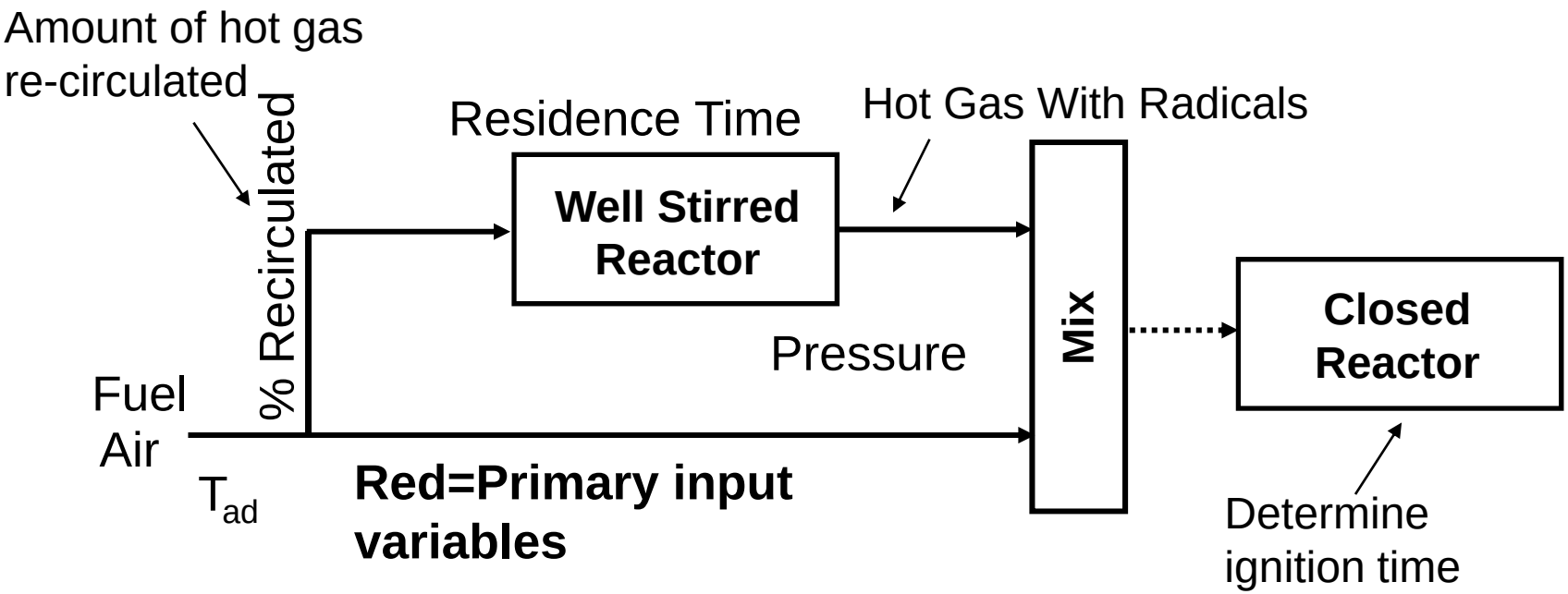
determine the lean blow out equivalence ratio and flame temperature for an inlet fuel and air mixture that can be partially pre-oxidized.



Incrementally decrease reactor inlet equivalence ratio until extinction

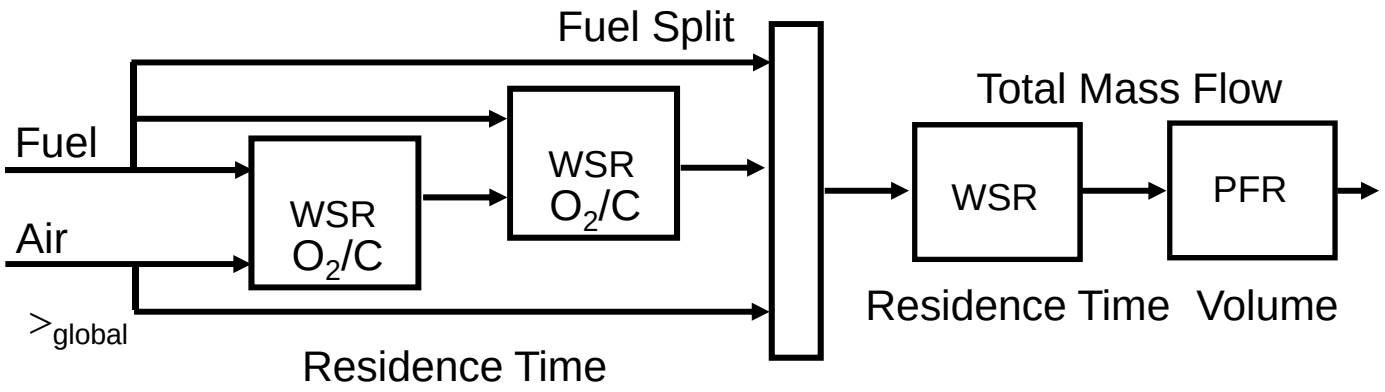
Induction Time Model

Simulate ignition time of incoming fuel with recirculation of hot gas with radicals as ignition source



Preliminary Chemkin Emission Models

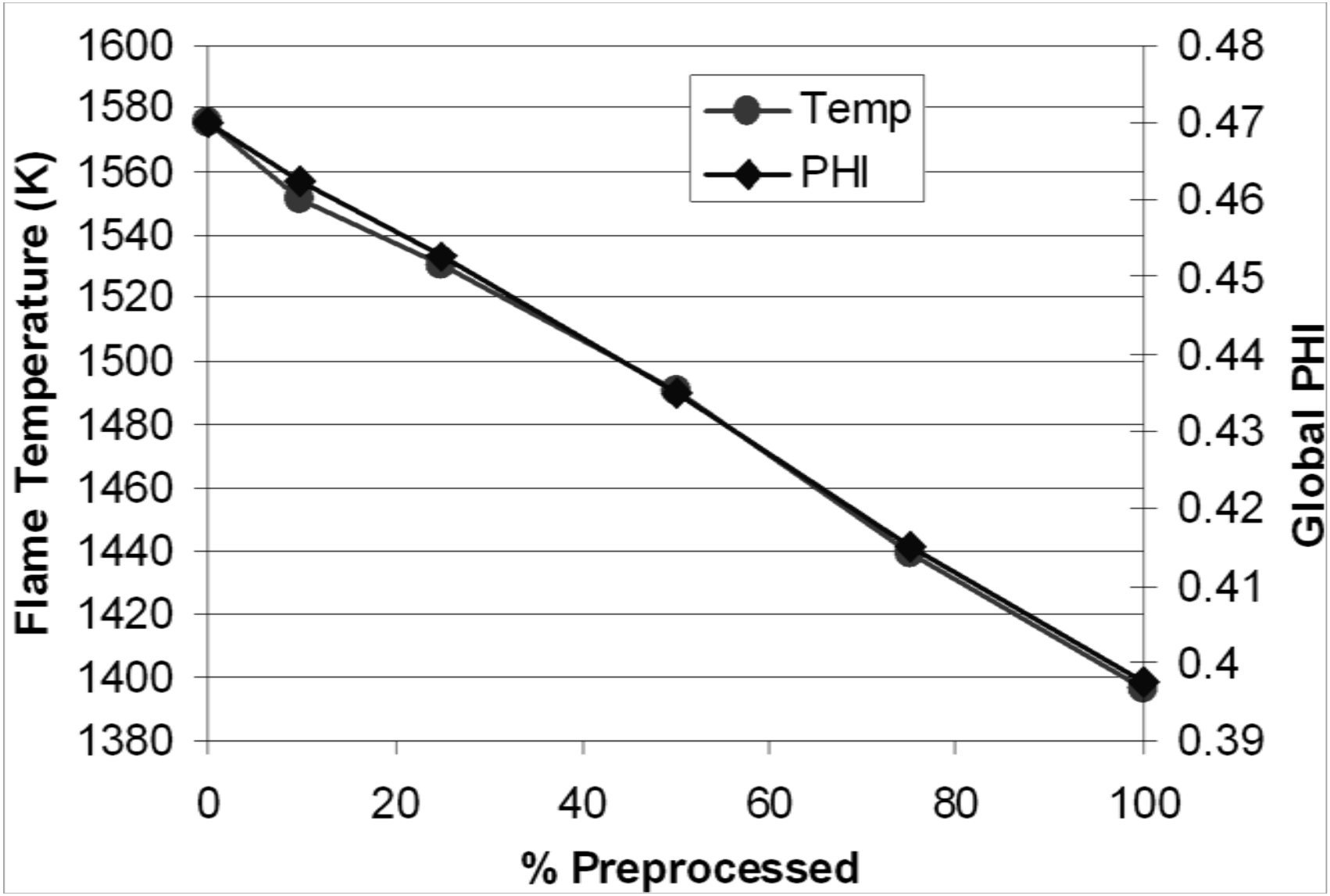
Evaluate potential carbon monoxide and nitrous oxide margin gain of fuel preprocessing



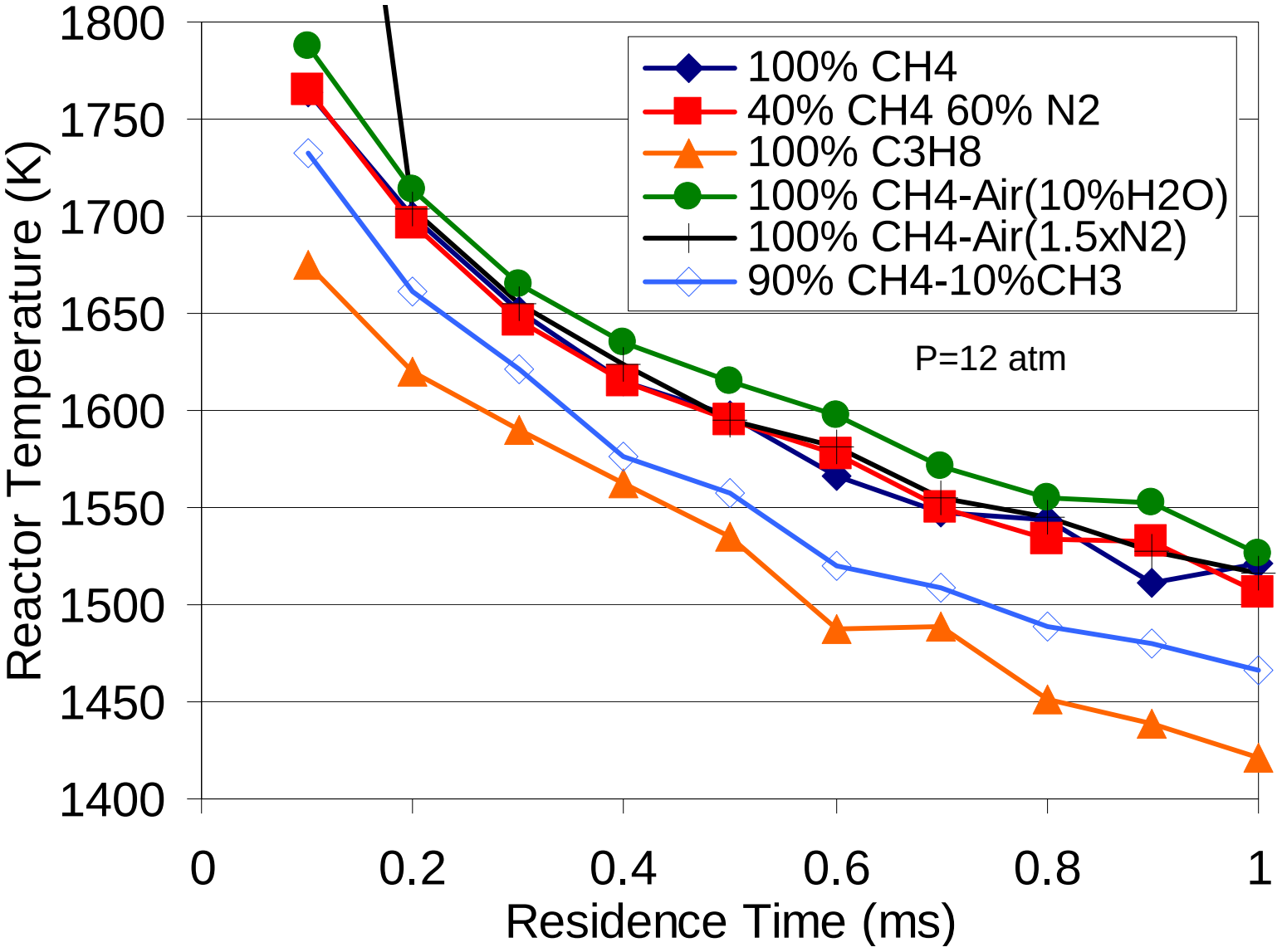
Does not model well the absolute pollutant emissions, but indicates trends for various operating conditions

Fuel Preprocessing LBO Improvement

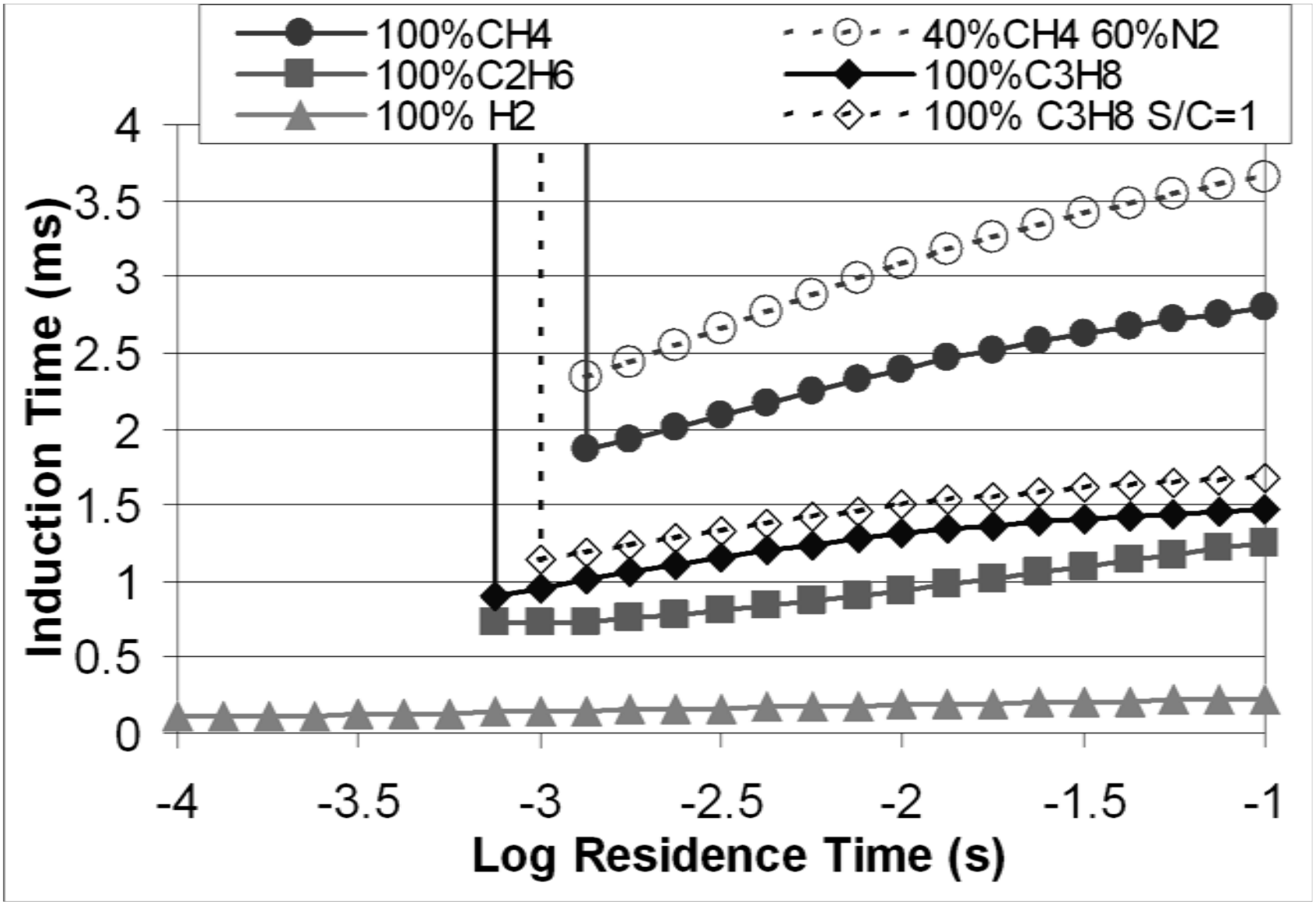
(Constant Residence time=0.5 ms, O_2/C=0.76)



Inlet Fuel Composition Effect on LBO

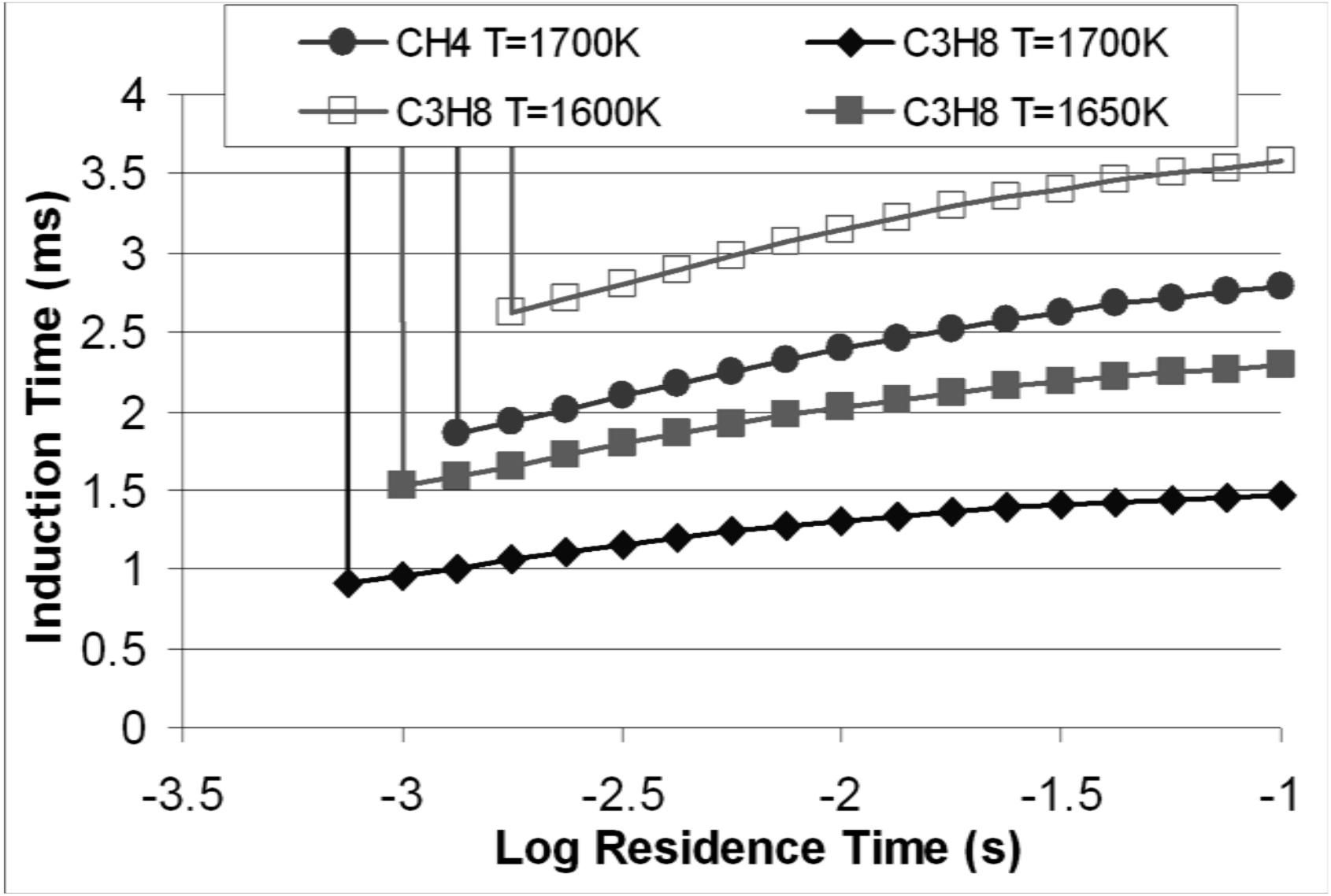


Fuel Variation Effect on Induction Time



Tad=1700K P=12 atm

Fuel Reactivity Adjustments



Emissions Margin Gain