NEW ENERGY

# FORUM

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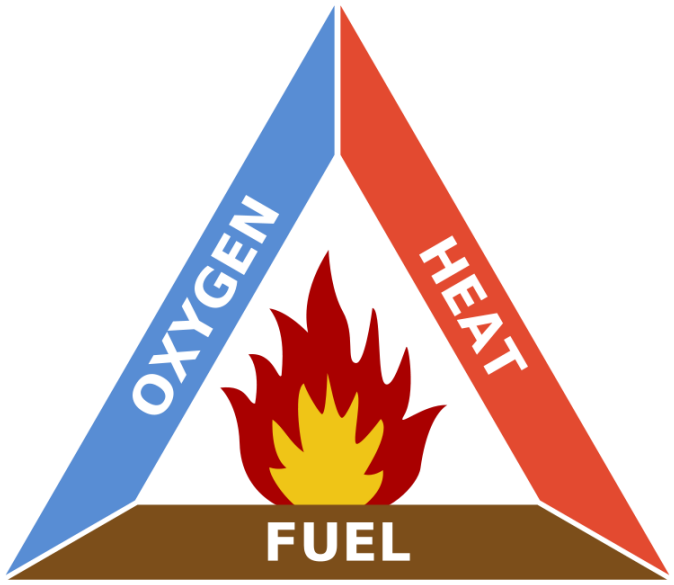
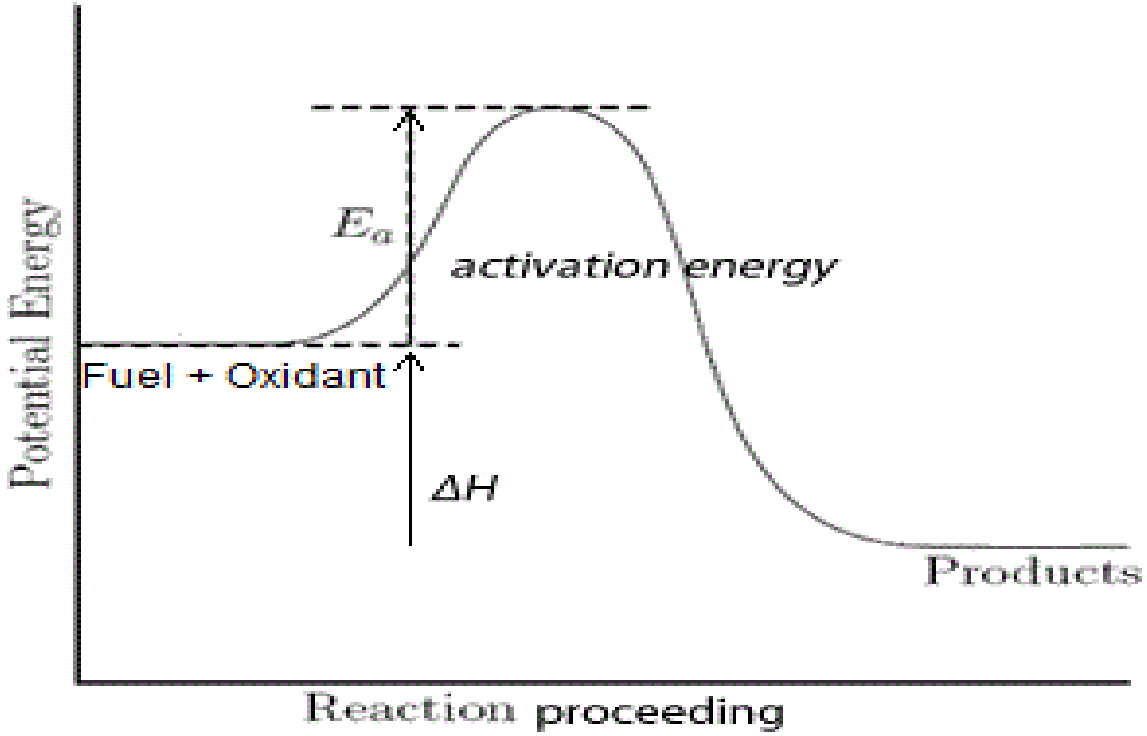
# Breaking Barriers

# *Numerical study of Ammonia combustion in a dual-fuel engine*

***Bahram Nourani***
***RuG - Energy Conversion research group***

# ✓Combustion phenomena



## ✓ *Ammonia is a promising fuel*

### ✓ *Advantages*

- *Carbon free energy carrier*
- *Possible renewable fuel*
- *Commercial availability*
- *Easy handling*
- *Global distribution*

### ✓ *Disadvantages*

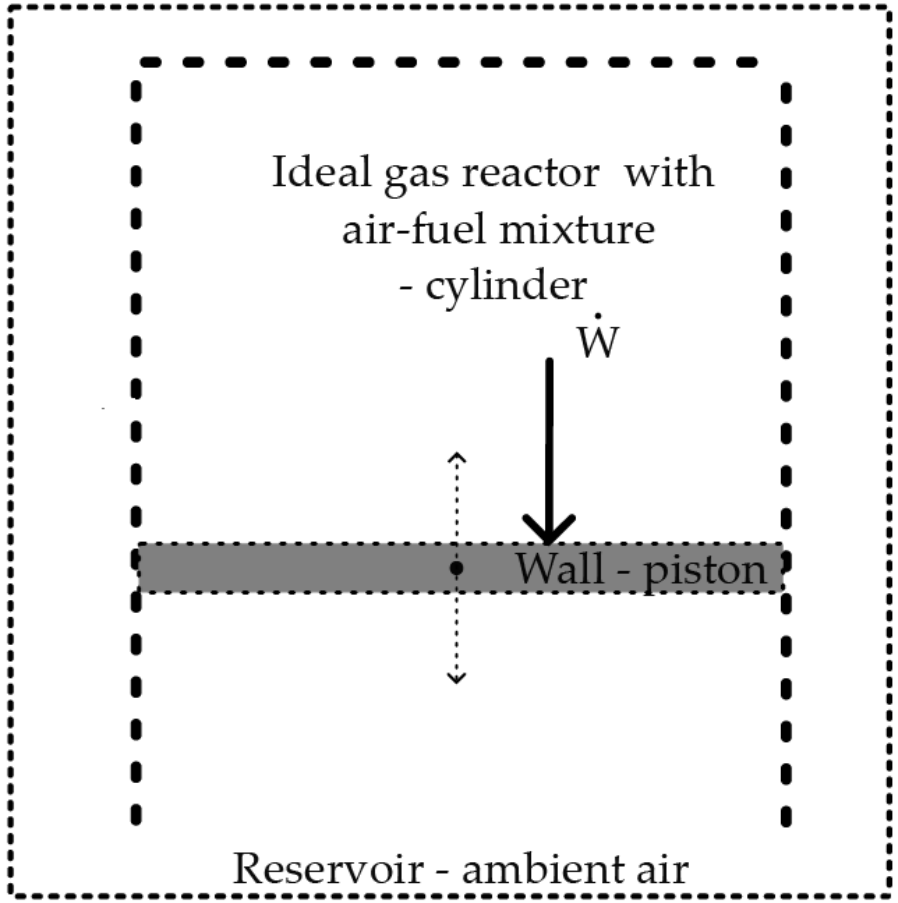
- *toxicity*
- *Corrosive*
- *NOX pollutants*

## ✓Purpose of the study

- ***Numerically investigating ammonia combustion in a dual-fuel engine using DME as a pilot fuel***

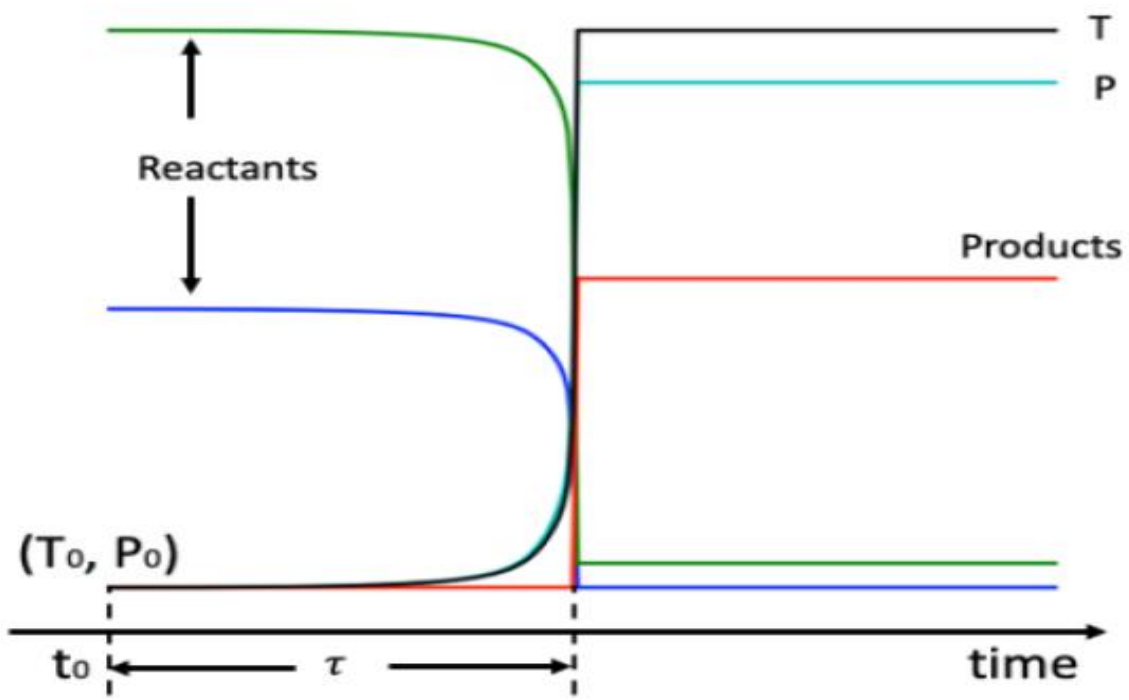
## ✓Model assumptions

- ***Homogeneous ideal gas reactor with no spatial gradients - Zero dimensional Reactor (0-D)***
- ***Closed system - no mass inflow or outflow during simulation***
- ***Adiabatic system - no heat loss to cylinder walls***



# ✓ *Kinetic calculation - homogeneous reacting gas mixture*

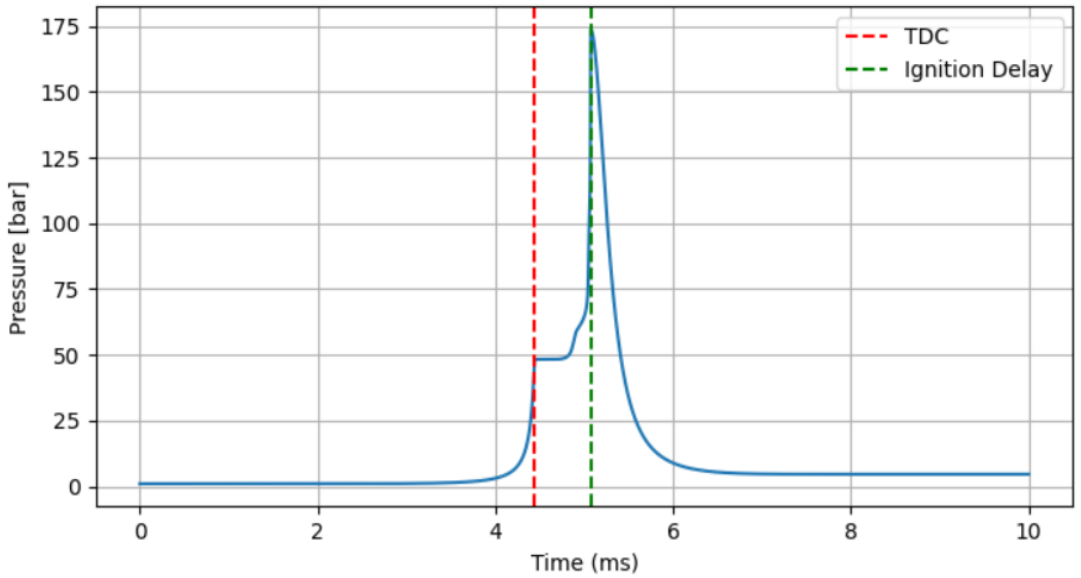
- ***Conservation of mass***
- ***Conservation of species***
- ***Conservation of energy***
- ***Ideal gas***

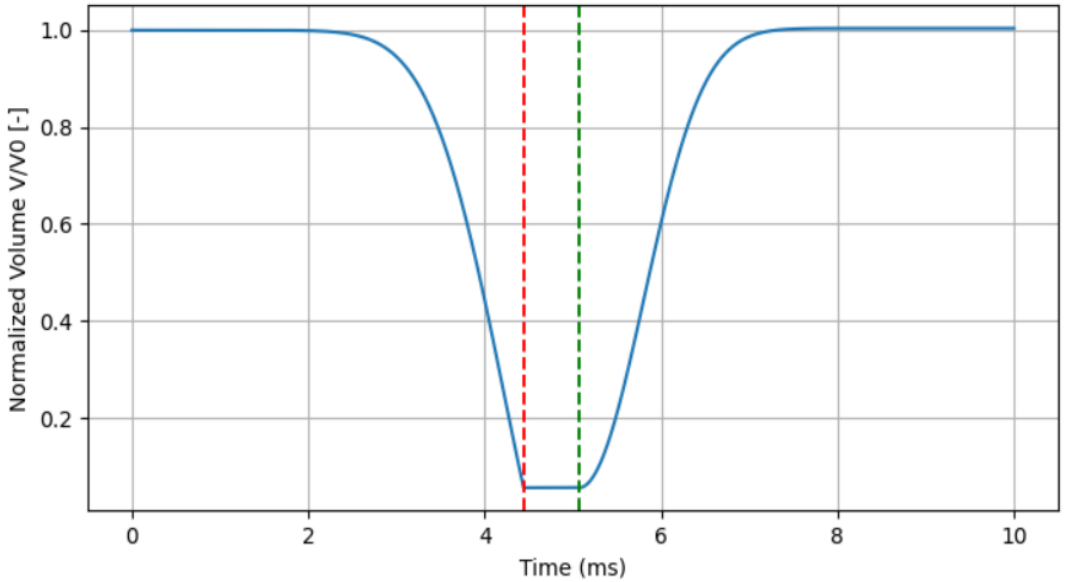



**Ignition delay time**

# ✓ Results

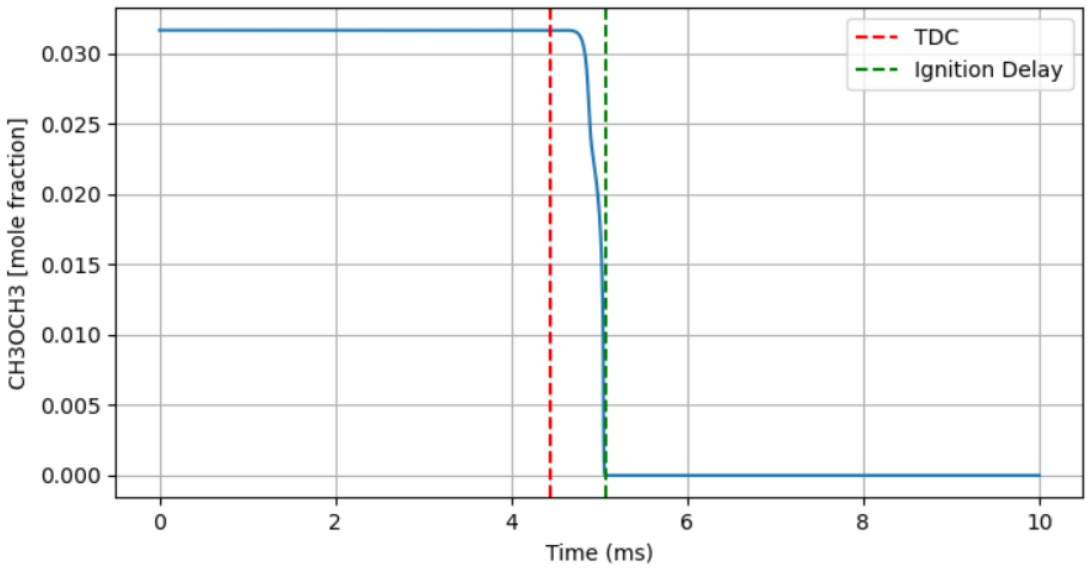
## *Pressure and normalized volume profiles, Phi=0.8, DME=0.3, NH3=0.7*

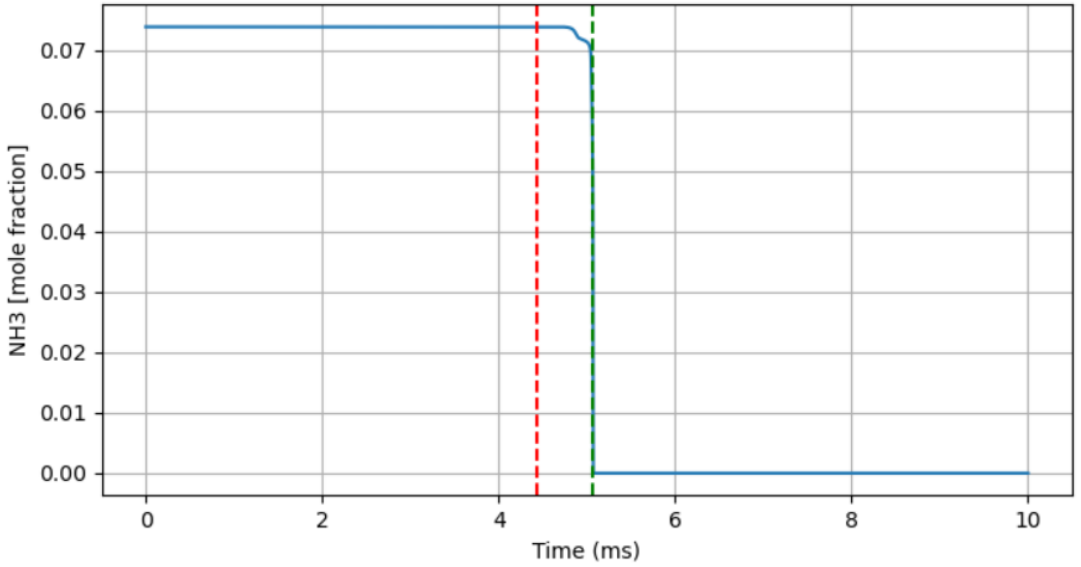


# ✓ Results

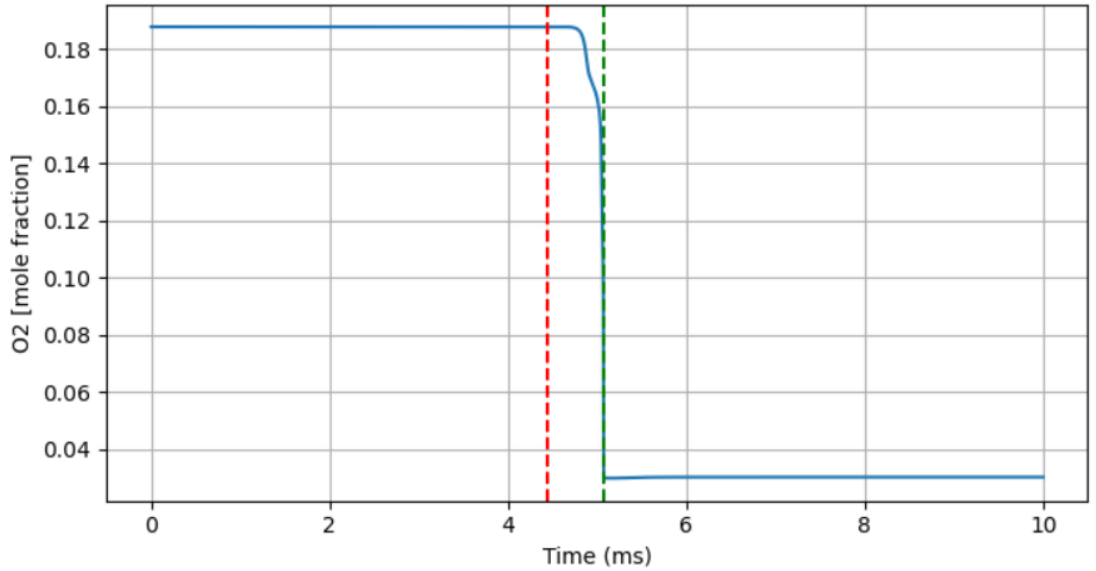
## NH3 and DME profiles, Phi=0.8, DME=0.3, NH3=0.7

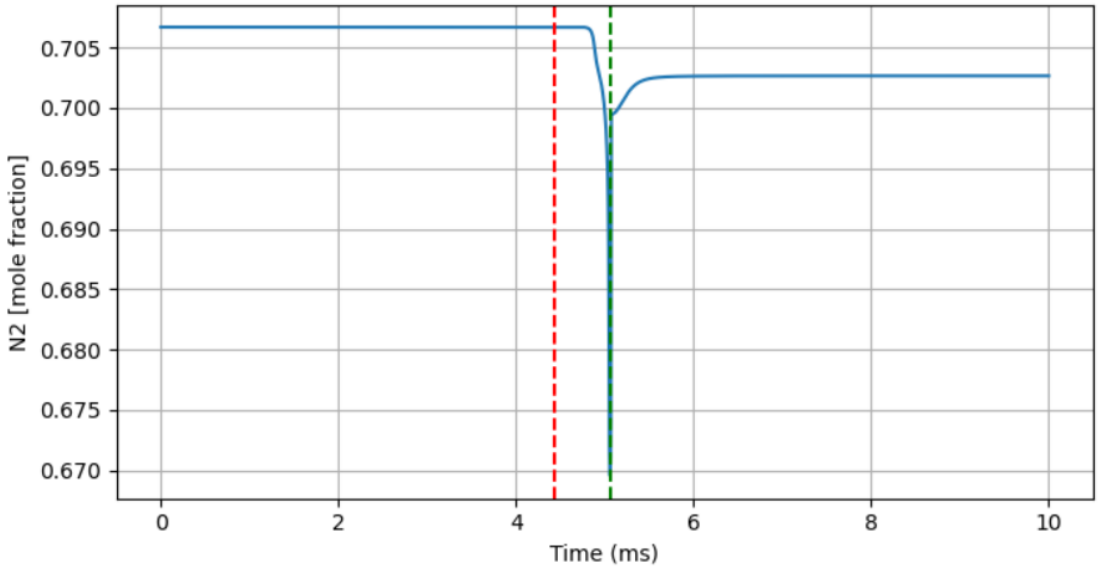


# ✓ Results

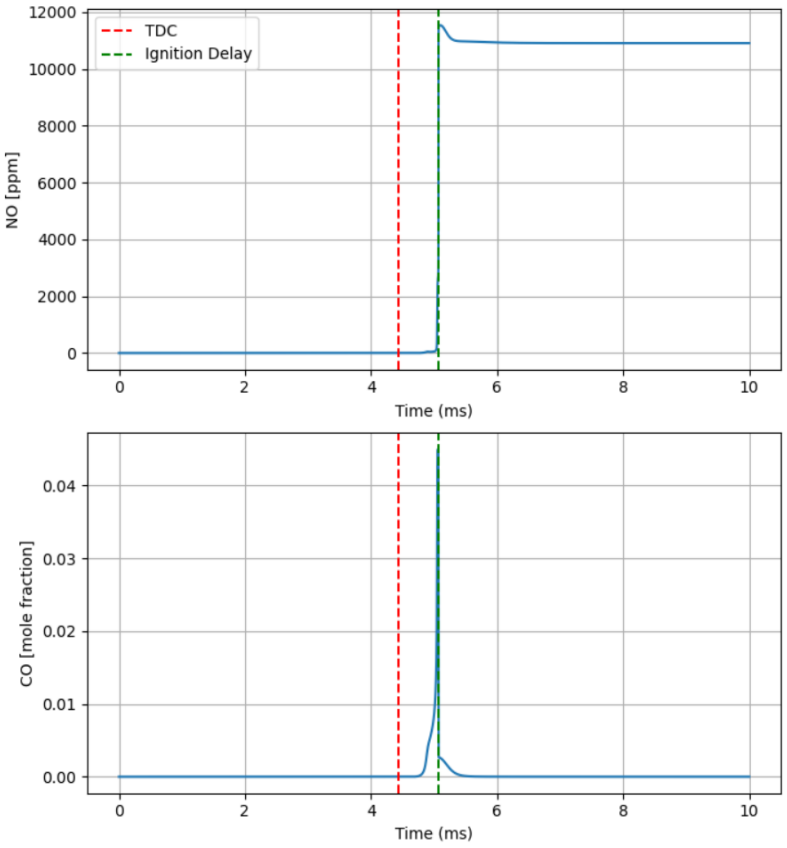
## *N2 and O2 profiles, Phi=0.8, DME=0.3, NH3=0.7*



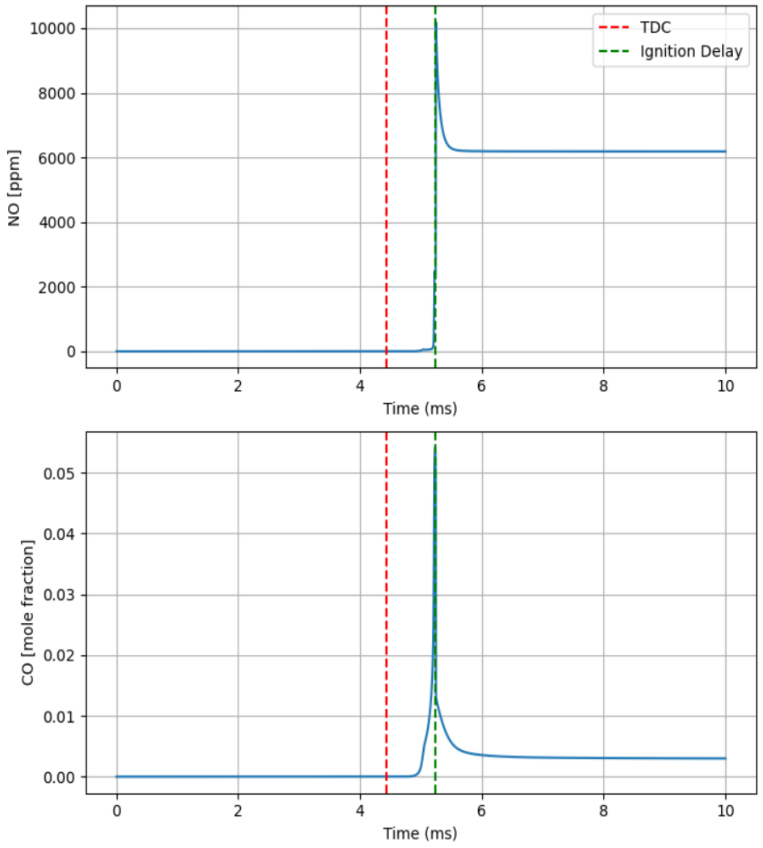
# ✓ Results *NO and CO profiles @Phi=0.8,1.0 and 1.2, DME=0.3, NH3=0.7*

## Phi=0.8



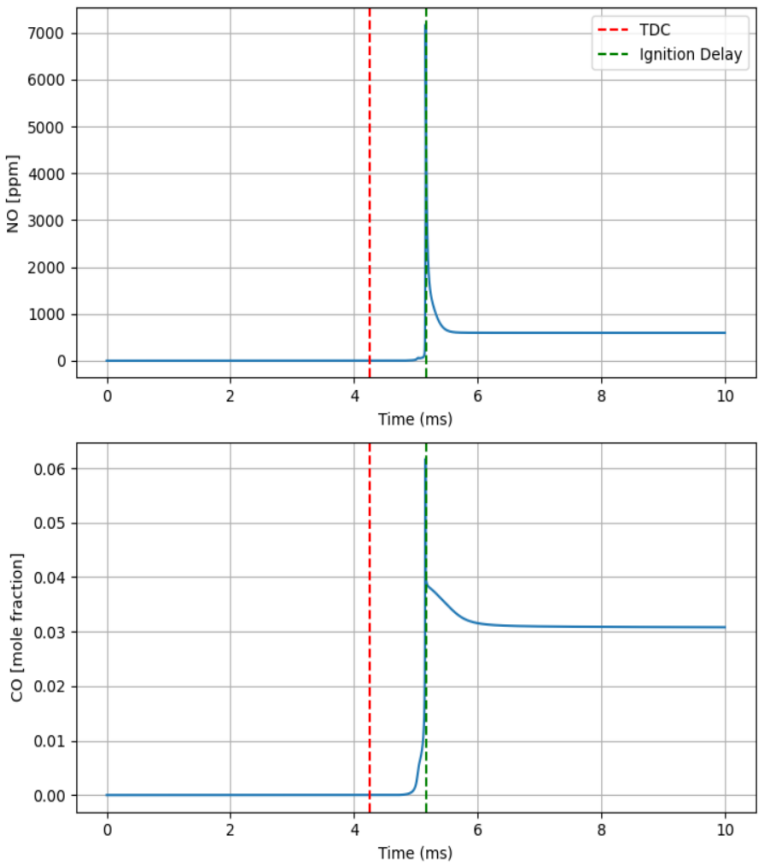

**Ignition delay time = 0.6 ms**

## Phi=1.0




**Ignition delay time = 0.8 ms**

## Phi=1.2




**Ignition delay time = 0.9 ms**

## ✓ *Conclusion*

- ***Substantial change of the combustion chemistry with $DME$addition.***
- ***Stable Combustion Under Rich Condition, phi=1.2***
- ***The NO concentration under rich conditions is lower than under lean or stoichiometric conditions, while the CO concentration is higher***