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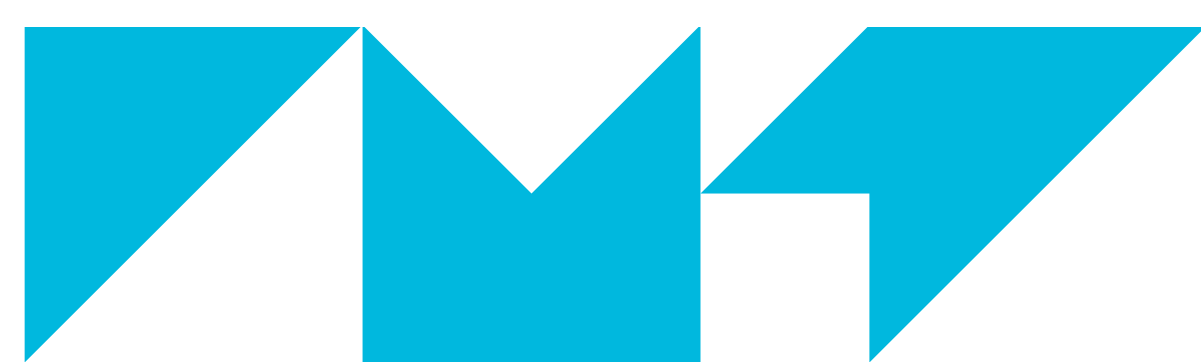
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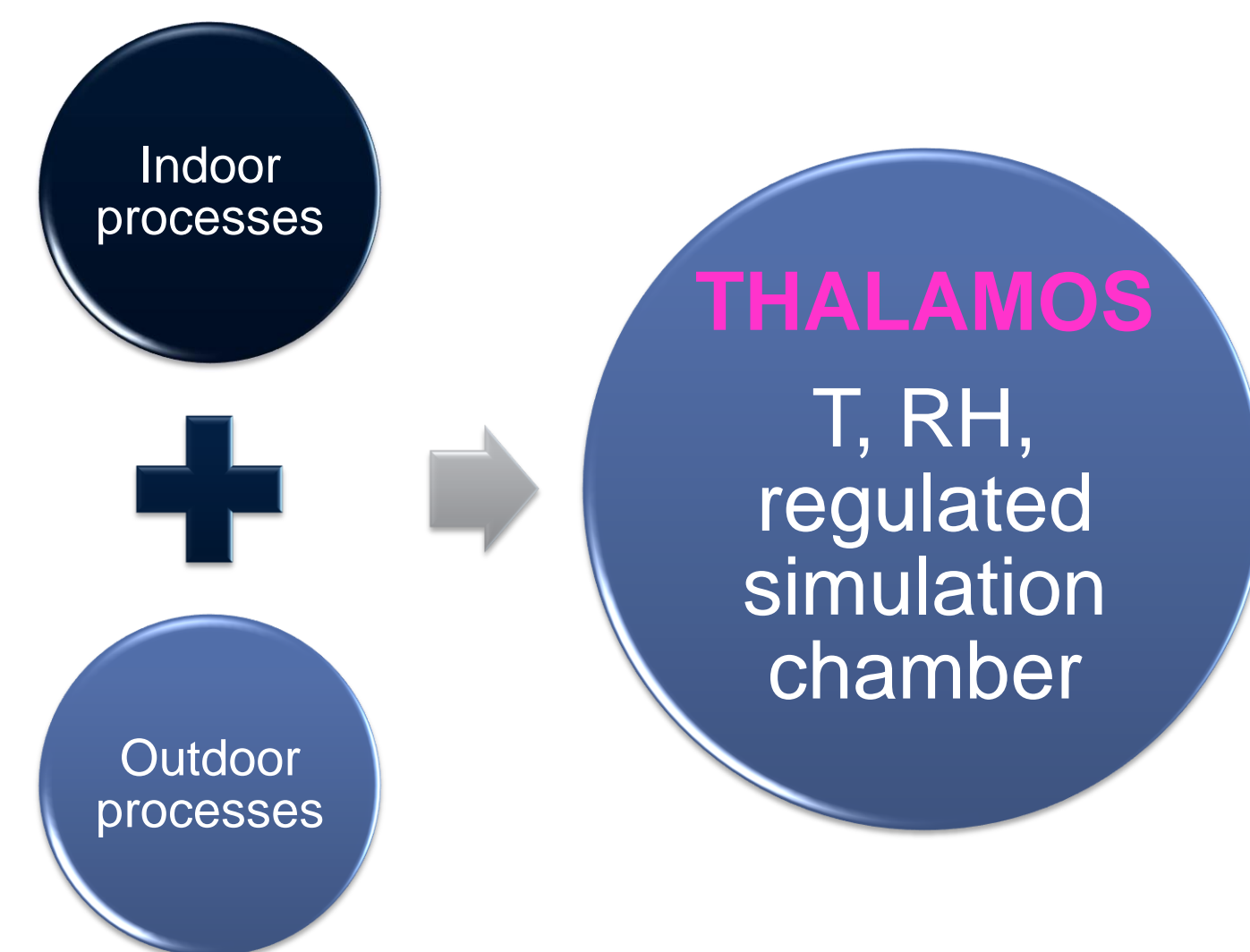
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# Development and validation of a Thermal regulated Atmospheric Simulation Chamber (THALAMOS)

## General Context - Objectives

Smog chambers, are unique tools for investigating crucial atmospheric processes in both gas and heterogeneous phase; they are supposed to provide a controlled, but realistic environment, aiming to simulate atmospheric conditions without any meteorological or emissive impact that occurs in real Atmosphere. Since environmental chambers first designing, back to the mid-1980s, several small- to large-scale facilities have been developed worldwide.

In the framework of the current study, a multi-purpose, medium size, Teflon atmospheric simulation chamber was designed and constructed, **THALAMOS (Thermal regulated Atmospheric simulation chamber)**, that can be operated in a wide temperature range (-40° to 100° C), at atmospheric pressure (760 Torr). THALAMOS is a unique experimental tool aiming to simulate both extreme outdoor and indoor processes and provide with both kinetic and mechanistic information with regard indoor and outdoor VOCs' Atmospheric degradation. To the best of our knowledge, **THALAMOS** is the first simulation chamber that can be operated in wide temperature range, at least in national level.

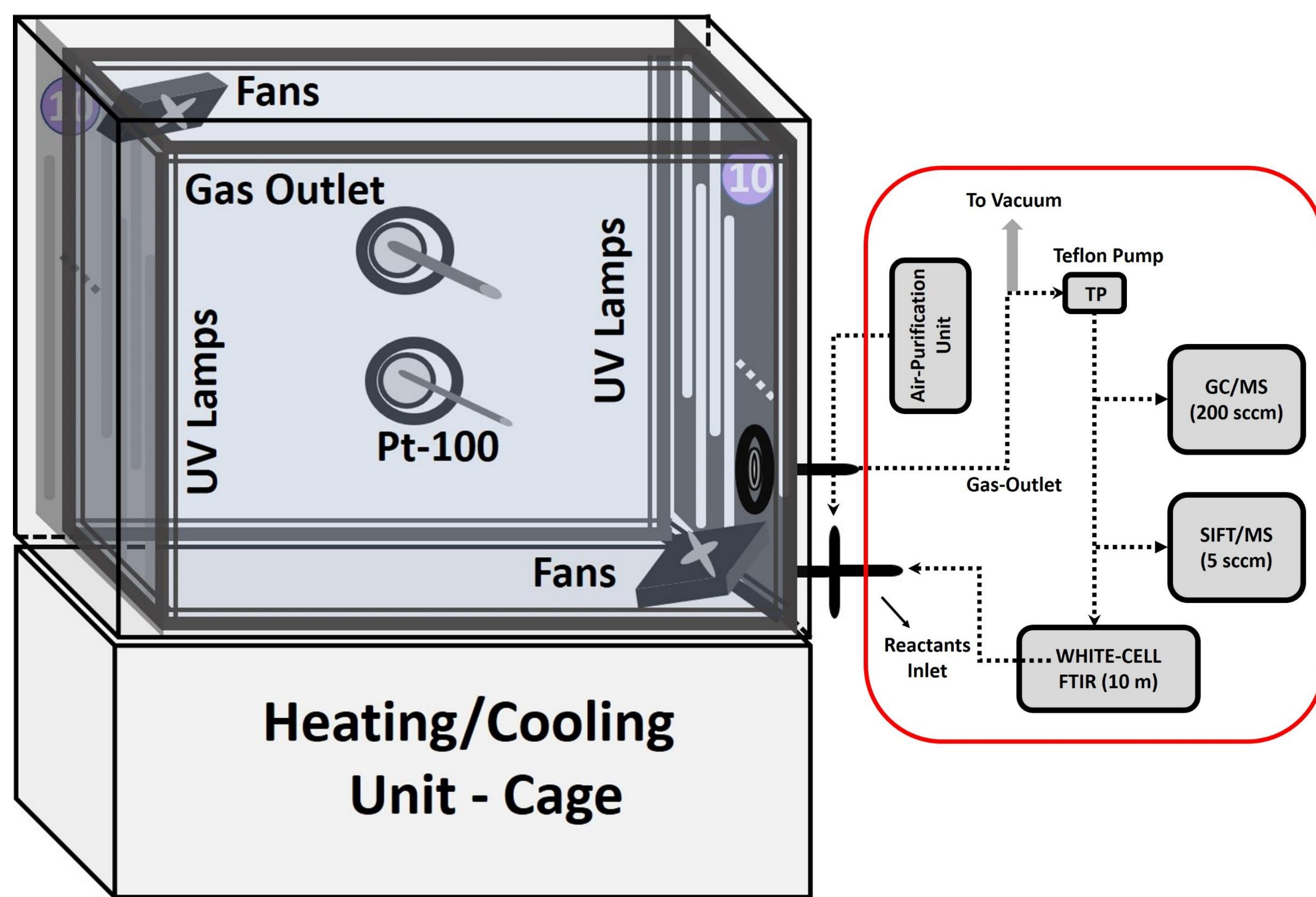


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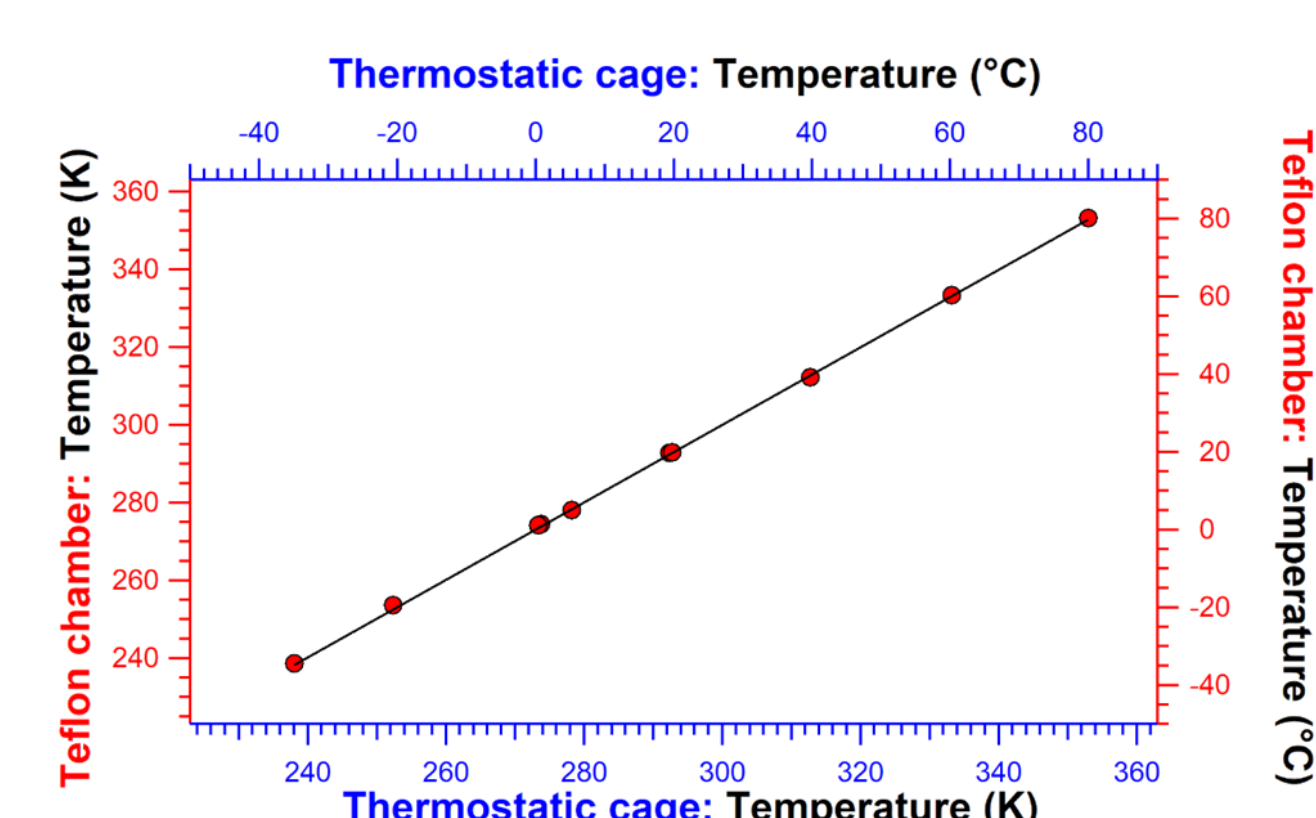
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## THALAMOS: General Description



| Parameters             | Values  |
|------------------------|---|
| Volume                 | 600 L (Titrated)  |
| Temperature range      | 235 – 373 K   |
| Light sources          | <ul style="list-style-type: none"> <li>10 to 20 UV-A (Philips PL-L 24W/10/4P), <math>\lambda_{max}</math> 365nm</li> <li>10 to 20 UV-C (OSRAM HNS-L 24W 2G11), <math>\lambda = 254</math> nm</li> </ul> |
| Mixing efficiency      | < 1 min after reactants injection   |
| Operational conditions | Static (dilution rate $< 10^{-7}$ s <sup>-1</sup> ) or slow flow  |
| Bath gas               | <ul style="list-style-type: none"> <li>Zero Air (RH ca. 2% at 293 K)</li> <li>Extra pure zero air (RH &lt; 2ppm, CO, CO<sub>2</sub> &lt; 80 ppb)</li> </ul>   |

### Temperature response



## Acknowledgements



## THALAMOS Validation

### Strategy

Determine the rate coefficients of well documented reactions as a function of temperature

### Relative rate method

$$\frac{d[S]}{dt} = -k_1 [S][X]$$

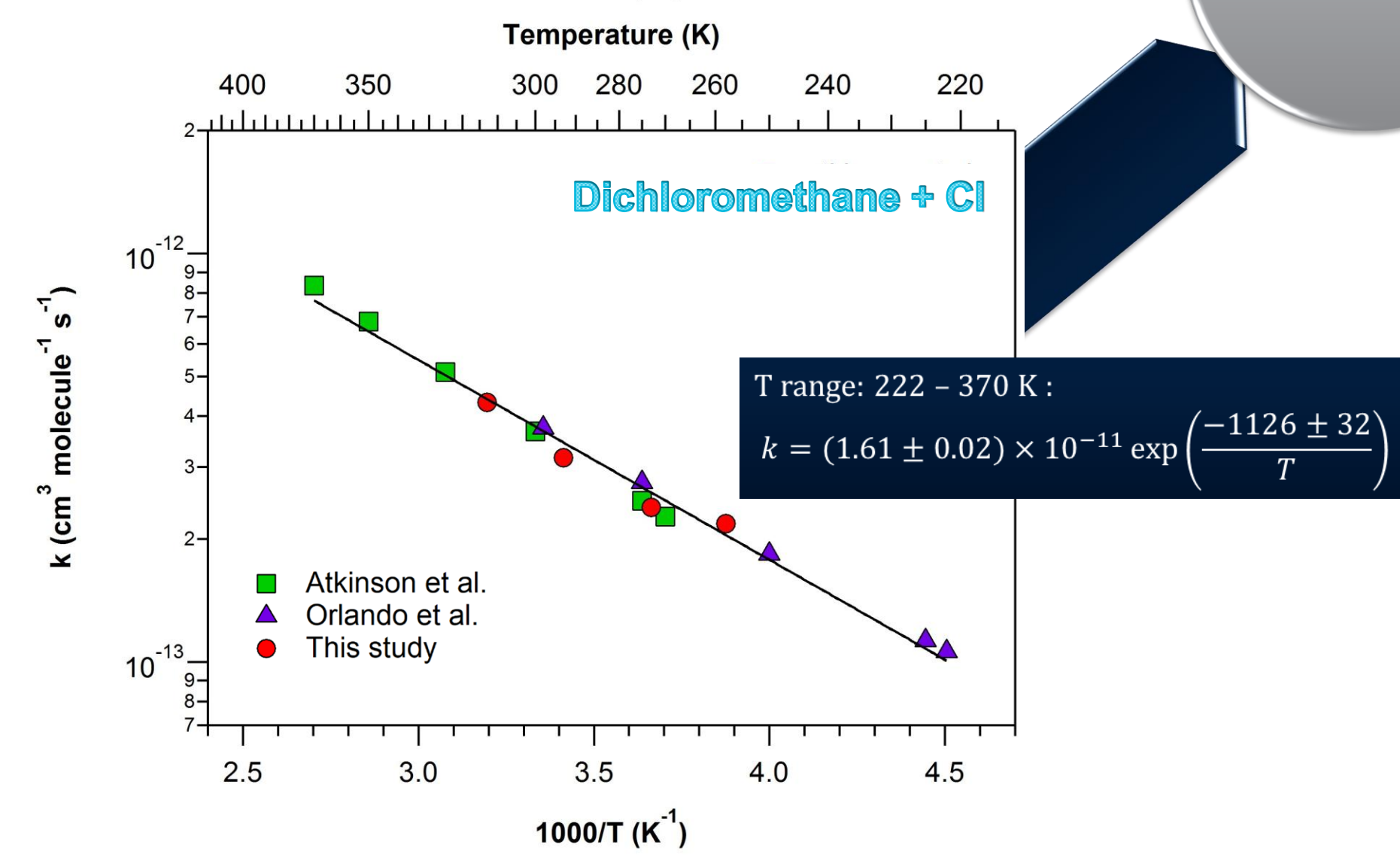
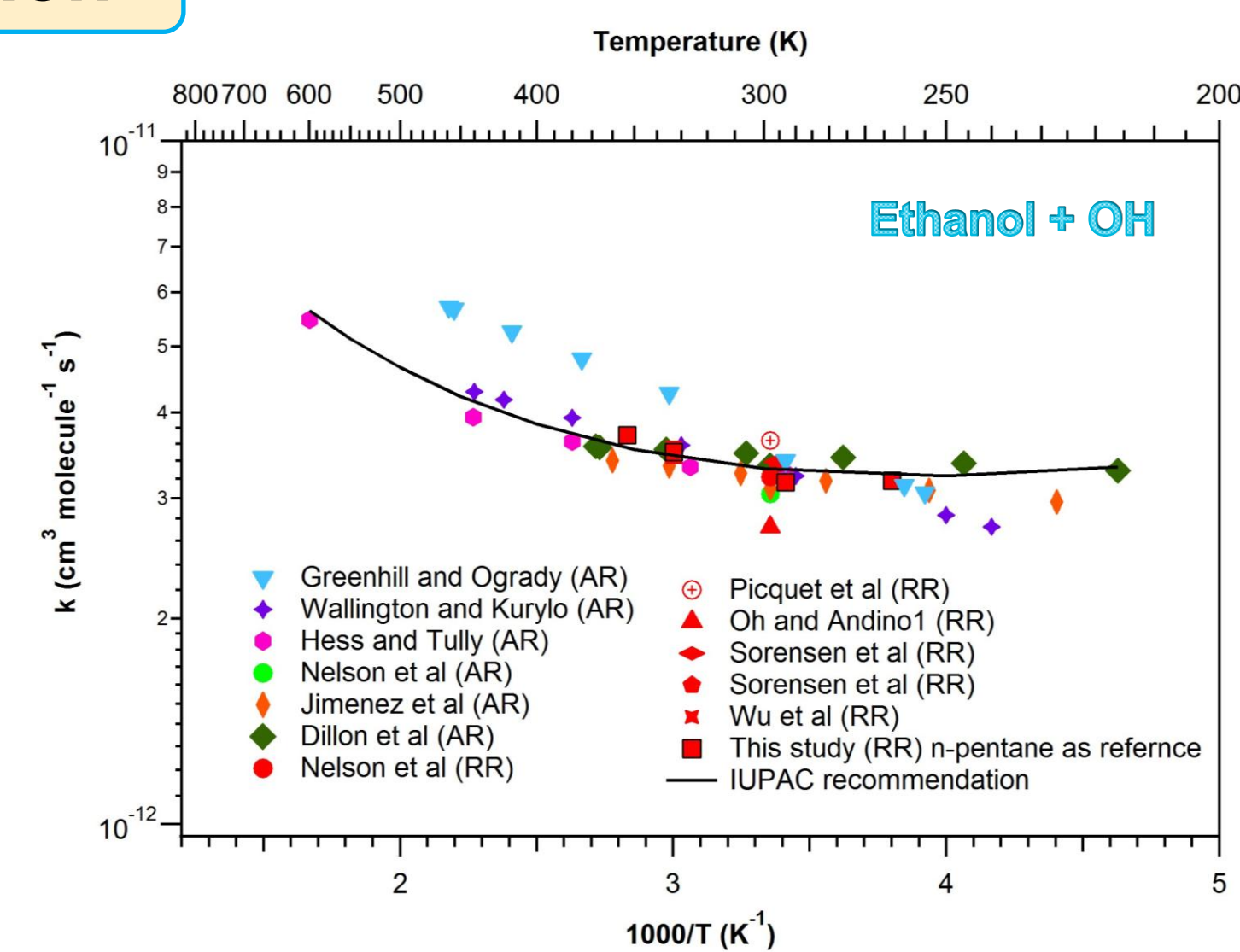
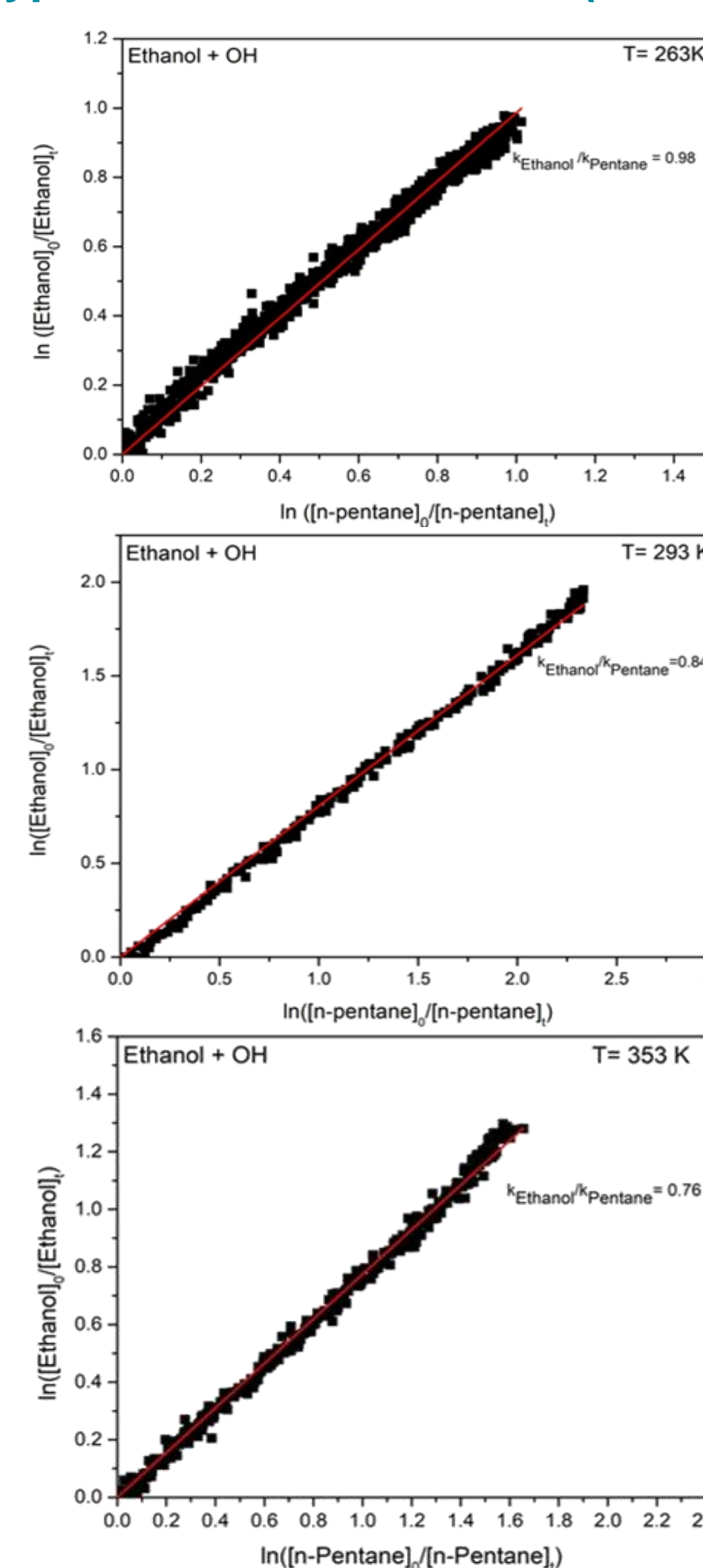
$$\frac{d[R]}{dt} = -k_{ref} [R][X]$$

$$\ln\left[\frac{[S]_0}{[S]_t}\right] = \frac{k_1}{k_{ref}} \ln\left[\frac{[R]_0}{[R]_t}\right]$$

**OH kinetics**  
C2H5OH + OH -> products  
C3H12 + OH -> products (reference)

**Cl kinetics**  
CH2Cl2 + Cl -> products  
CH4 + Cl -> products (reference)

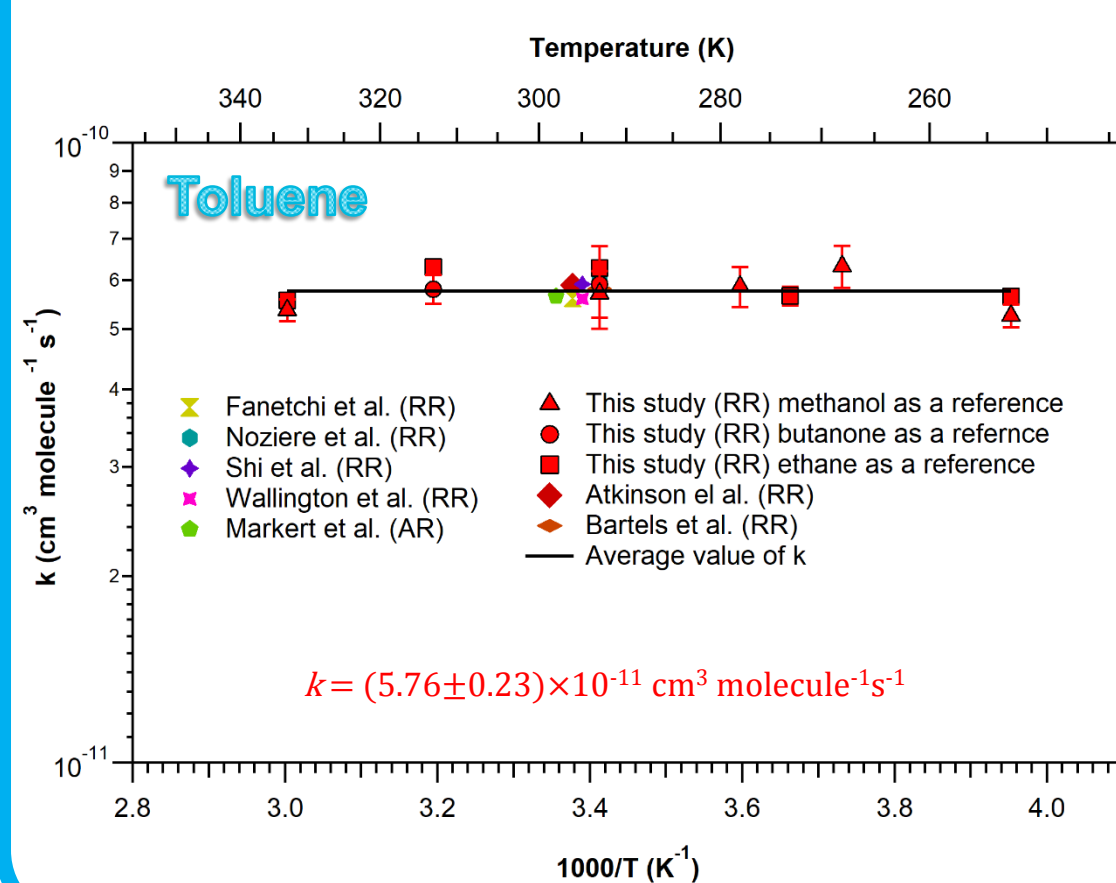
### Typical RR Measurements (SIFT-MS)



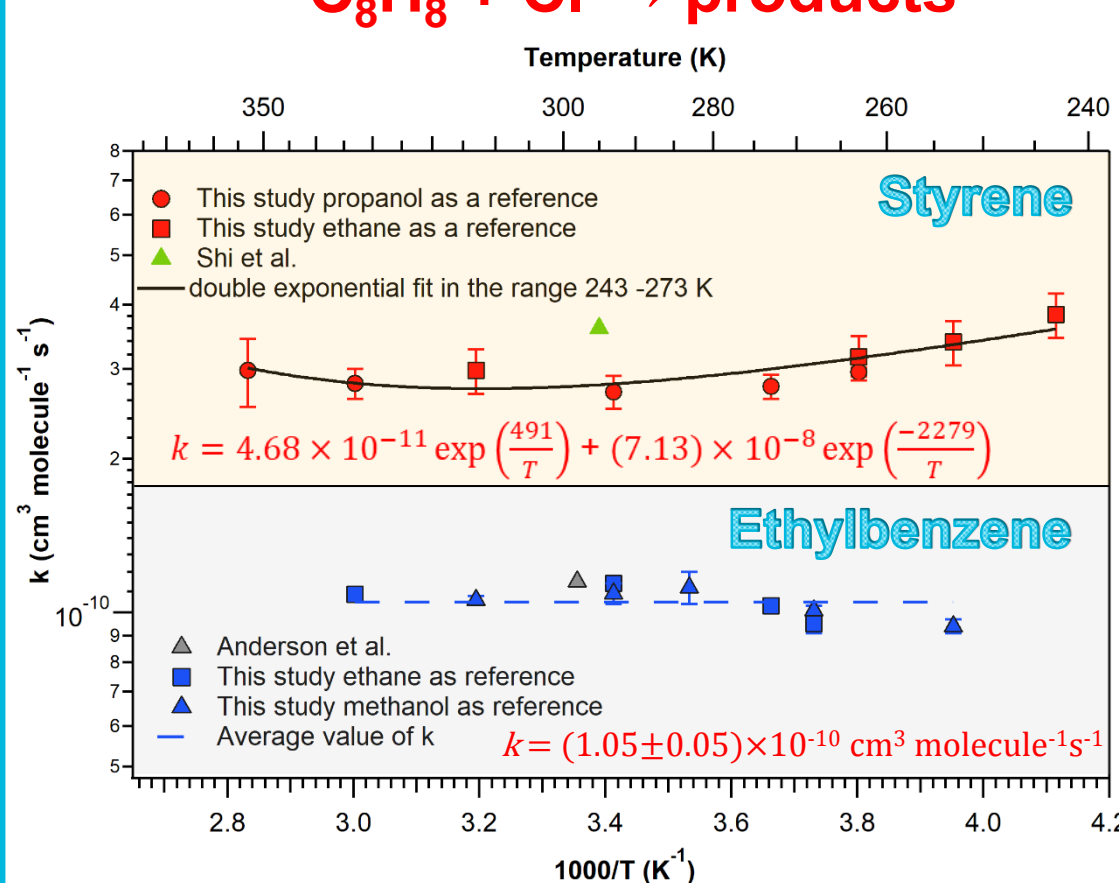
THALAMOS Validated

## Cl Reactivity Towards Aromatic H/C

### C7H8 + Cl -> products



### C8H10 + Cl -> products C8H8 + Cl -> products



## Undergoing Research:

- > Cl Initiated Oxidation of Aromatic Hydrocarbons
  - > Furan-based Biomass Burning Products Degradation via Reaction with the Major Atmospheric Oxidants: Kinetics and Mechanism
- ### Perspectives
- > VOCs Reactivity Towards NO<sub>3</sub> Radicals as a Function of Temperature: Kinetics and Mechanism
  - > SOA Formation as a Function of Temperature
  - > Heterogeneous reactions of liquid/solid particles with atmospheric pollutants

## Acknowledgements

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