Catalytic Activity of Vanadium Oxide Nano-clusters

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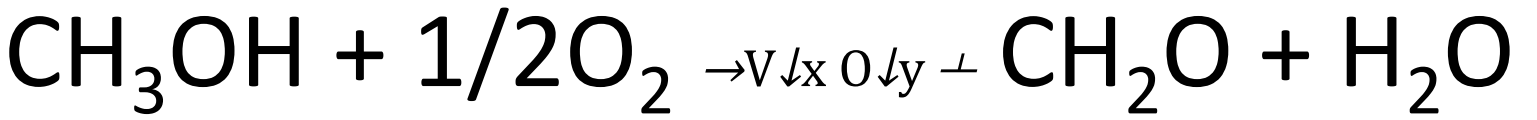
Our goal is to understand Vanadium Oxides on a nano-scale

- Small clusters exhibit peculiar properties
- We want to fundamentally understand these properties
- New materials with these properties can be created with cluster deposition

Finding the catalytically active clusters is the first step

- Synthesize various vanadium oxide nano-clusters (V_xO_y)
- Deposit and run experiments on the vanadium oxide nano-clusters
- Understand how vanadium oxide performs its role as a catalyst

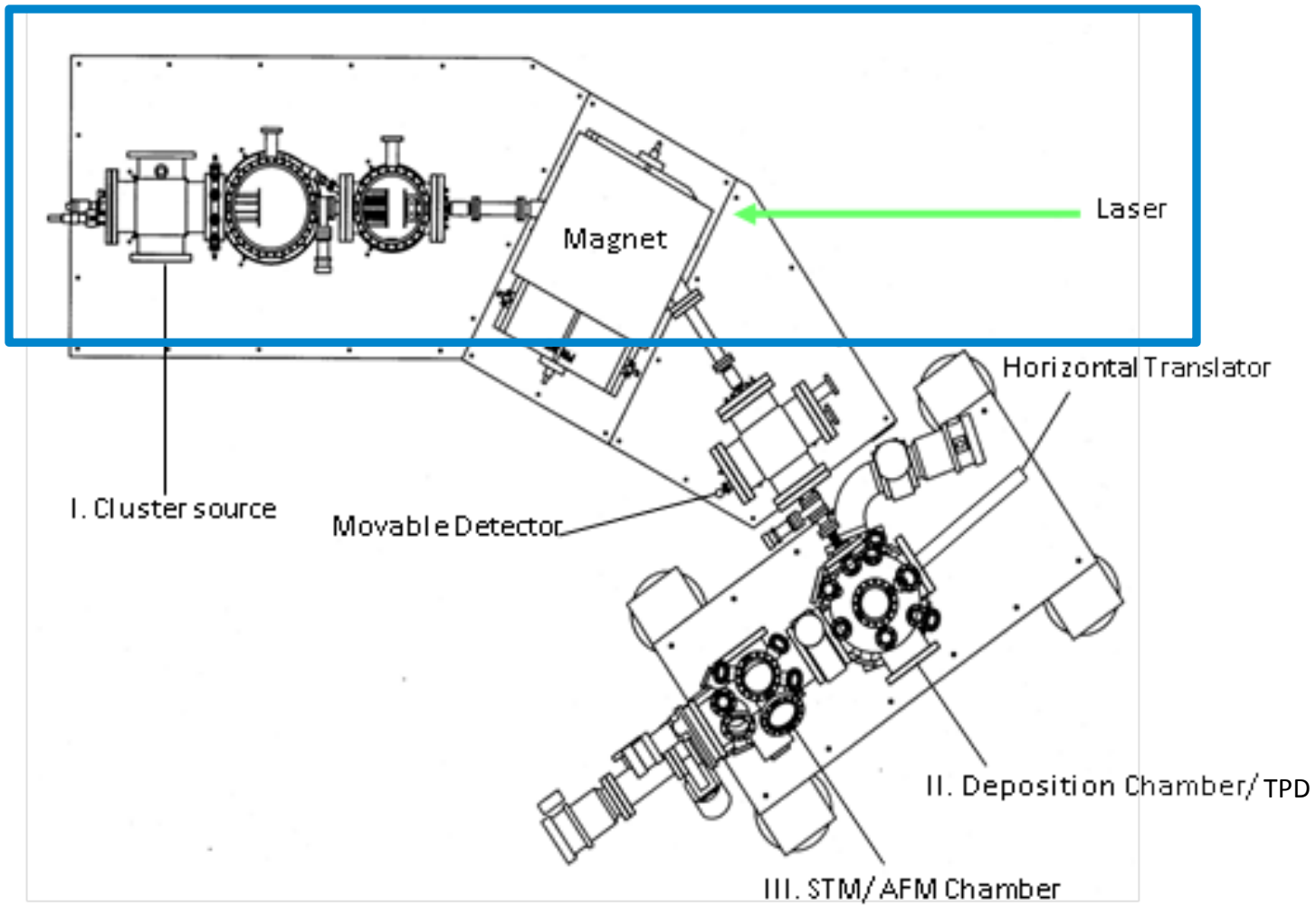
The partial oxidation of methanol to formaldehyde



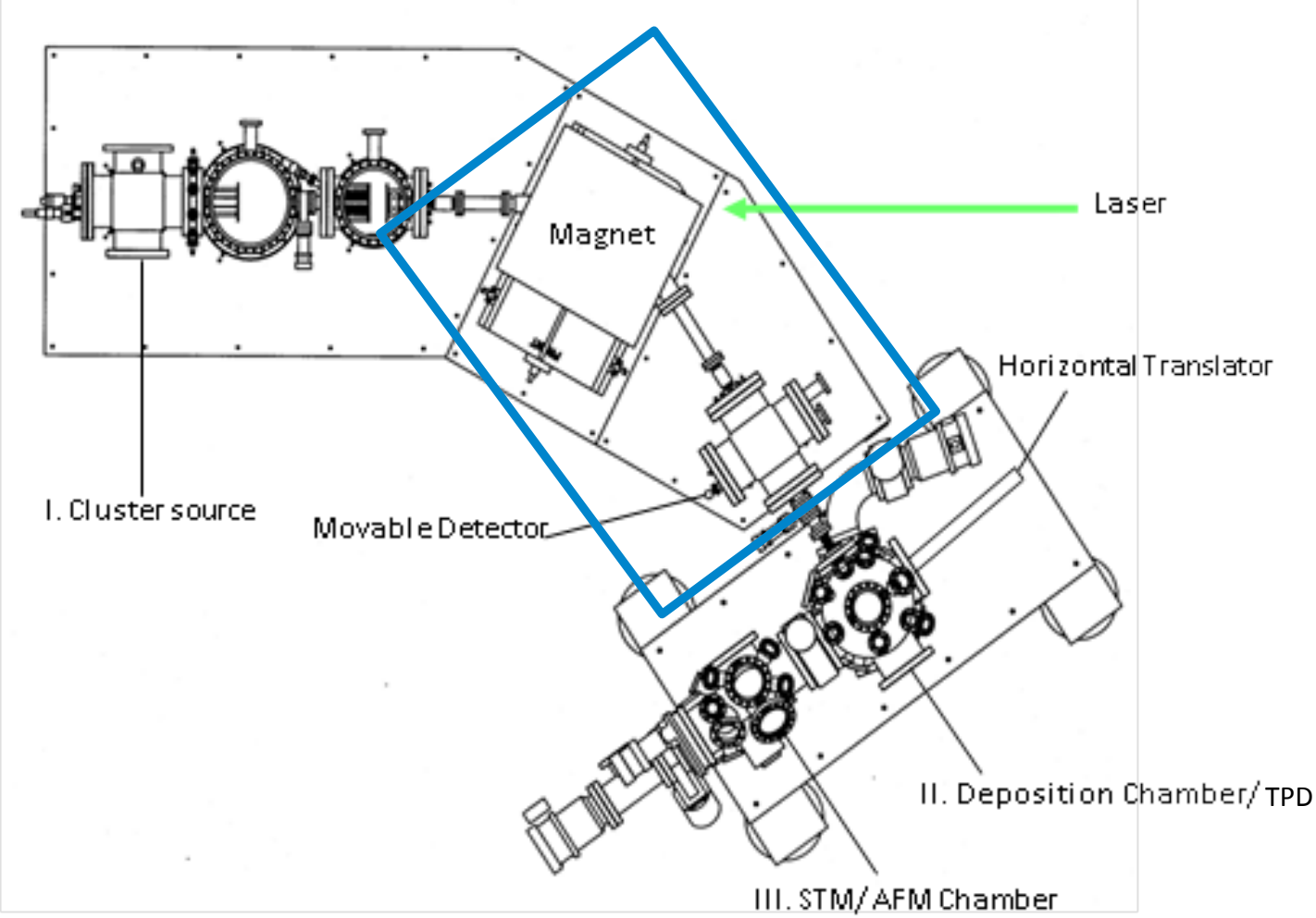
methanol

formaldehyde

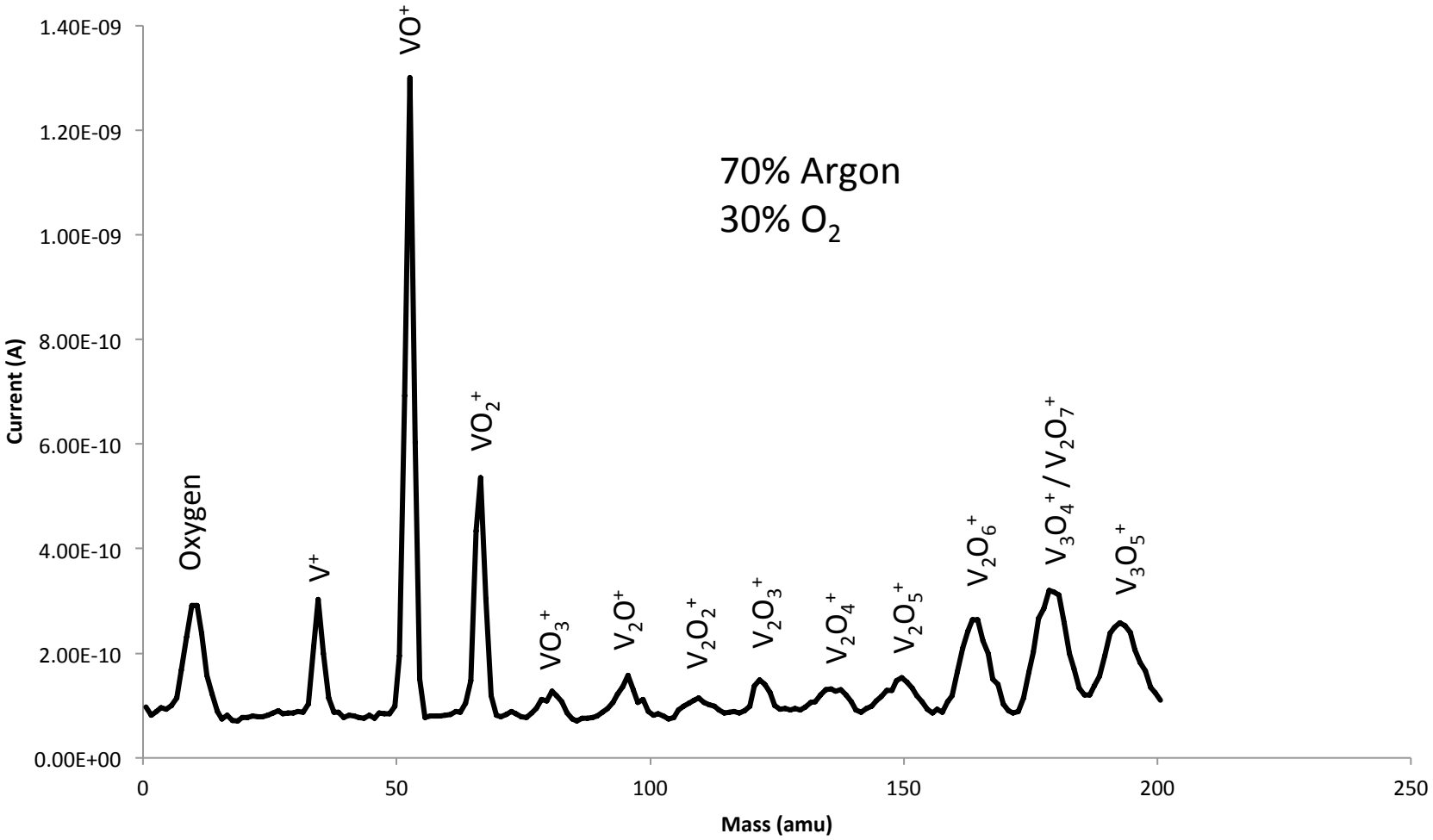
Creation of ionized Vanadium Oxides with laser ablation



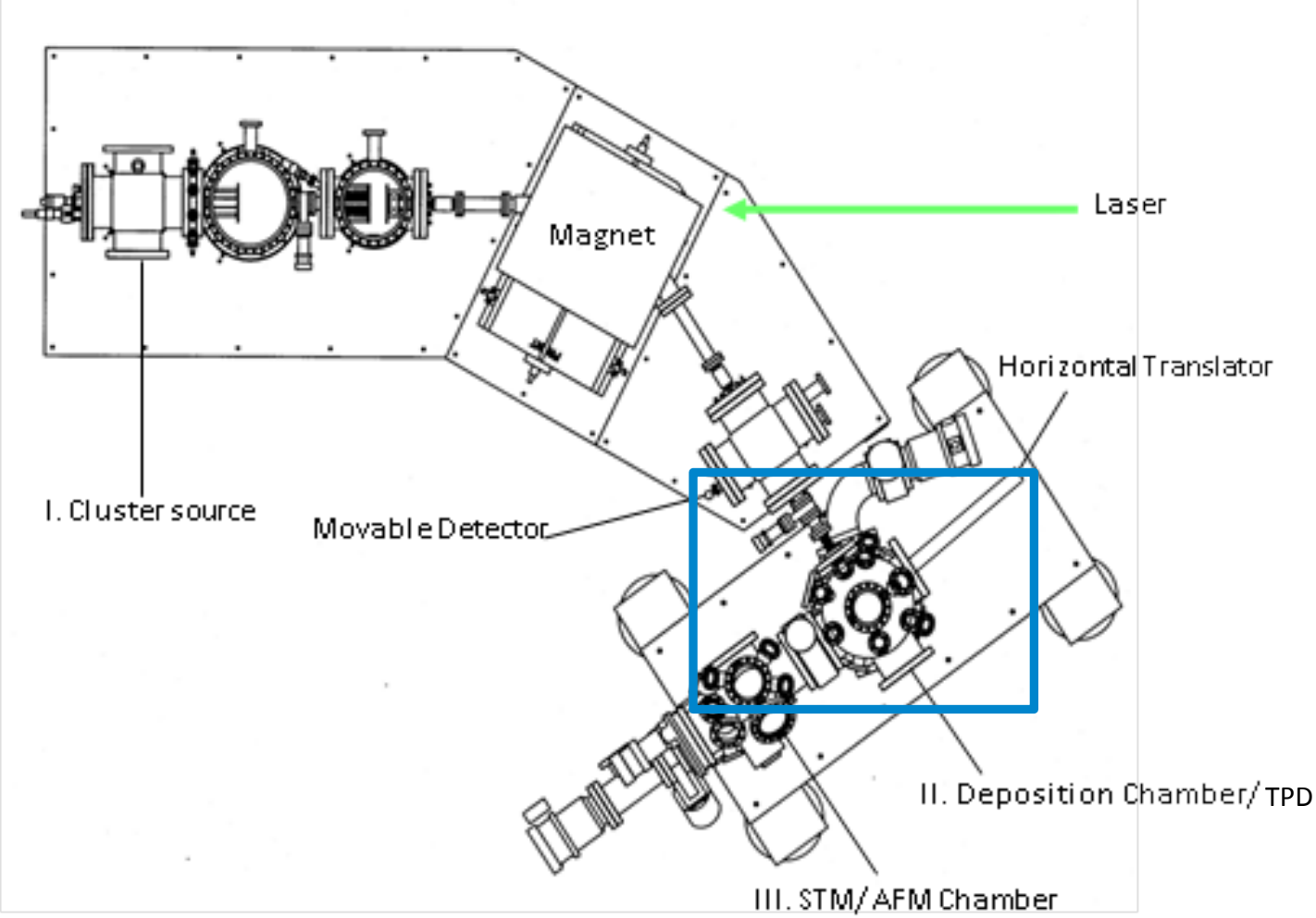
Mass selection of Vanadium Oxides by a controllable magnet



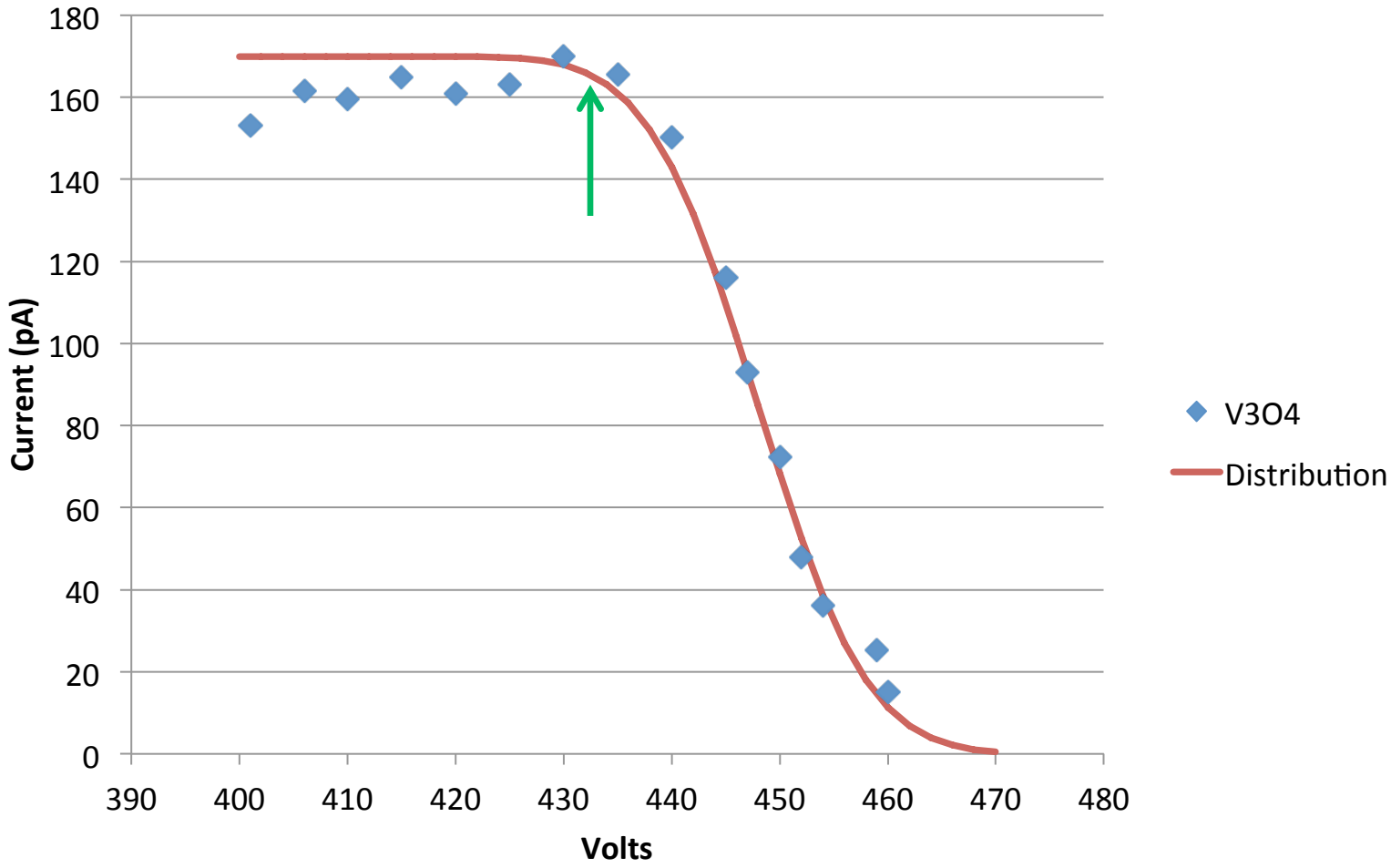
Synthesizing and identifying various vanadium oxides



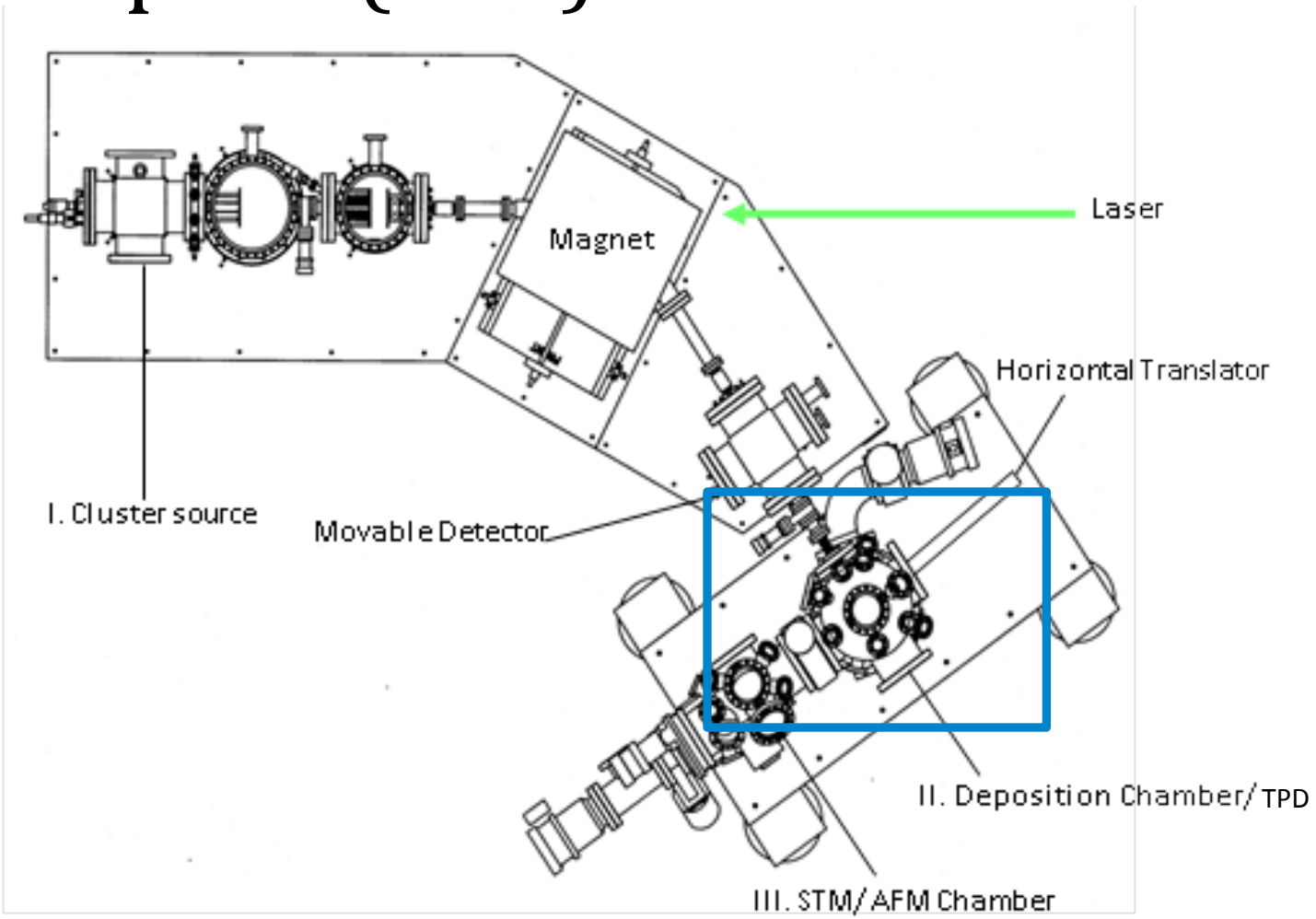
Soft landing Vanadium Oxides onto the TiO_2 surface



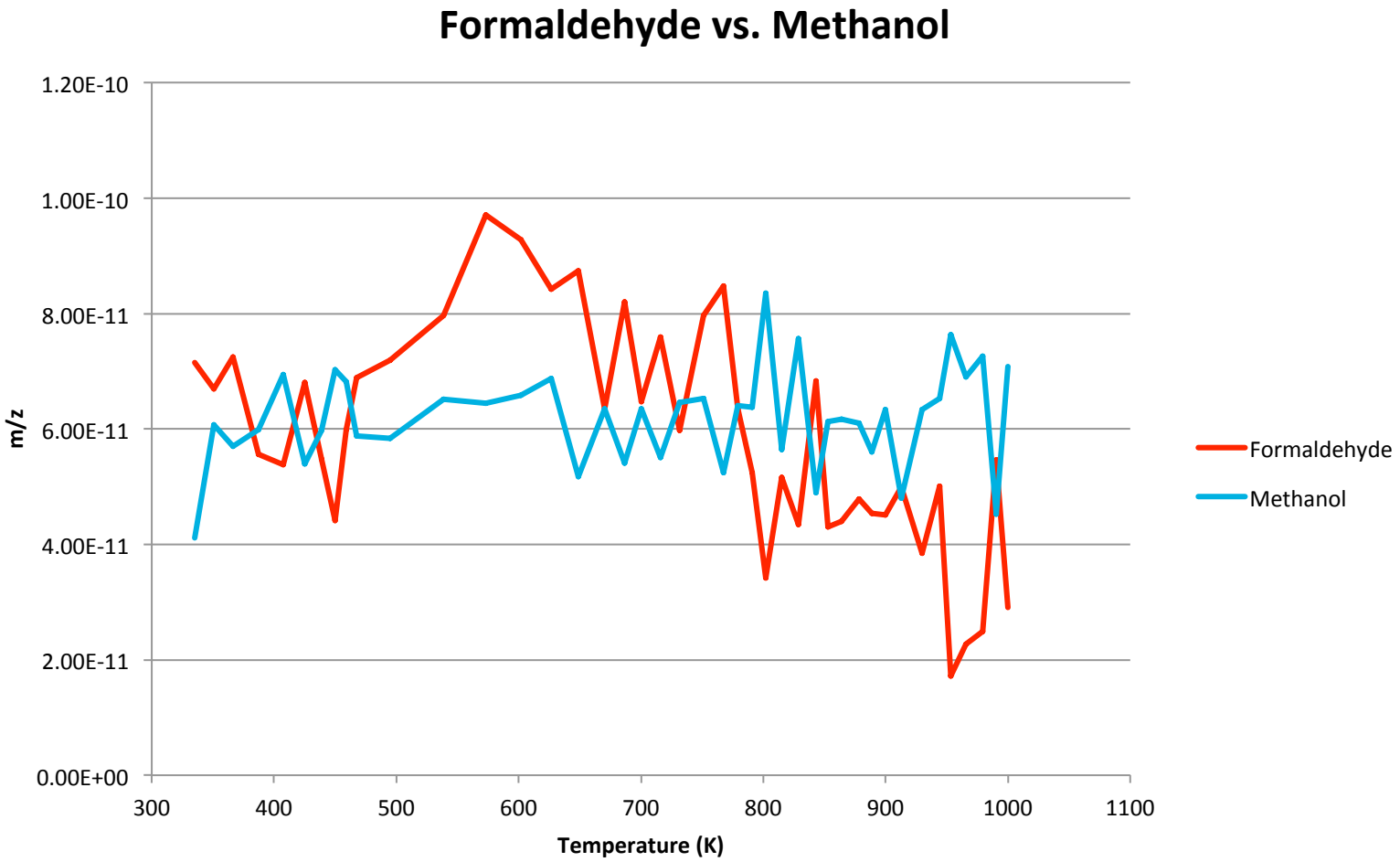
Determining the biasing voltage needed to soft land $V_3O_4^+$ ions



Determining catalytic behavior with temperature programmed desorption (TPD)



$V_3O_4^+$ possibly exhibits catalytic behavior for the studied reaction



What We Have so Far

- Successfully deposited $V_2O_6^+$ and $V_3O_4^+$
- Performed temperature-programmed desorption on both species
- $V_3O_4^+$ possibly exhibits catalytic behavior

Future Goals

- Continue to deposit and run TPD experiments on the other vanadium oxides
- Perform X-ray Photoelectron Spectroscopy (XPS)
- Image the surface with Scanning Tunneling Microscopy (STM)

Acknowledgments

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