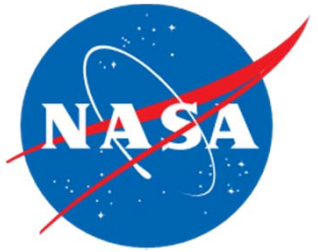
National Aeronautics and Space Administration




# Electrochemical Evaluation of Dimethylsilanediol

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Tougaloo College

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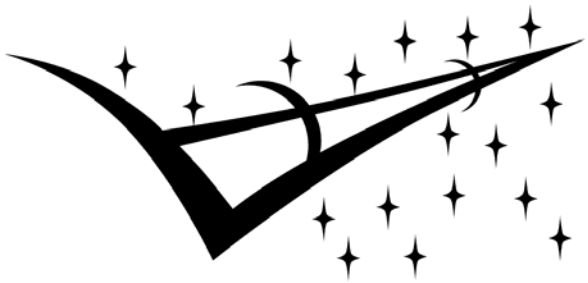
Water and Food Analytical Lab

SPACE LIFE SCIENCES
SUMMER INSTITUTE



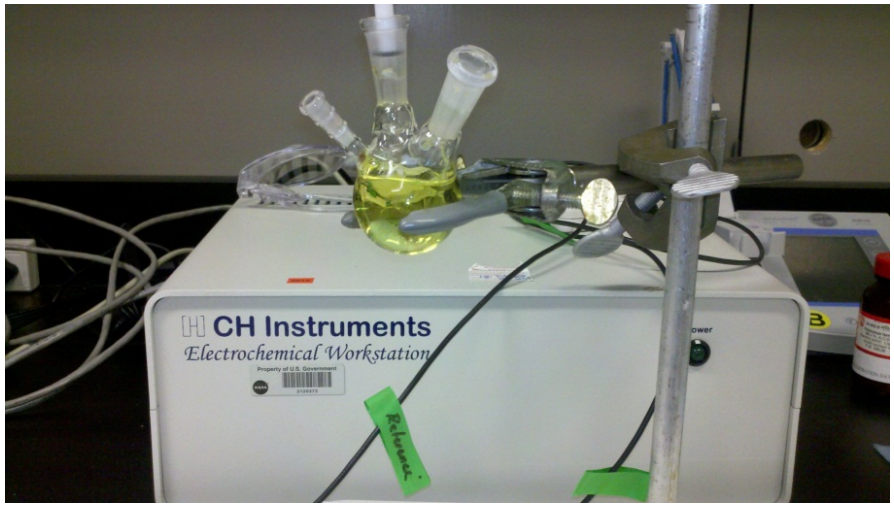
# Introduction

- Macon, MS
- Rising senior
- Biology major
- Public Health: Occupational Health and Safety
- Why Nasa?

1. great opportunities to experience different STEM areas
2. many different career options.
3. innovative, ever changing, exciting, and new

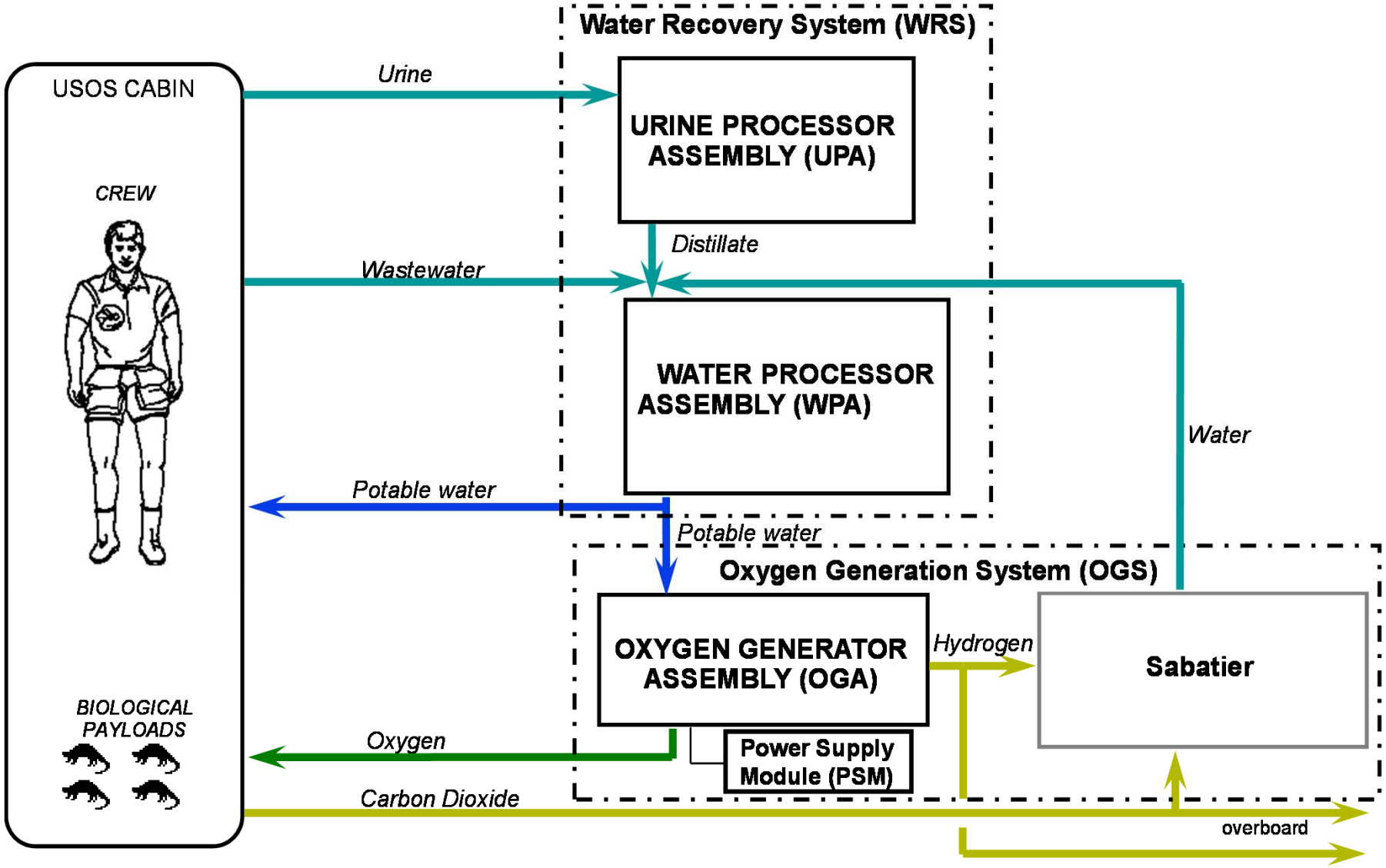
# Objectives of Internship

- To become familiar with electroanayltical techniques in the laboratory
- Perform electrochemical analysis of solutions

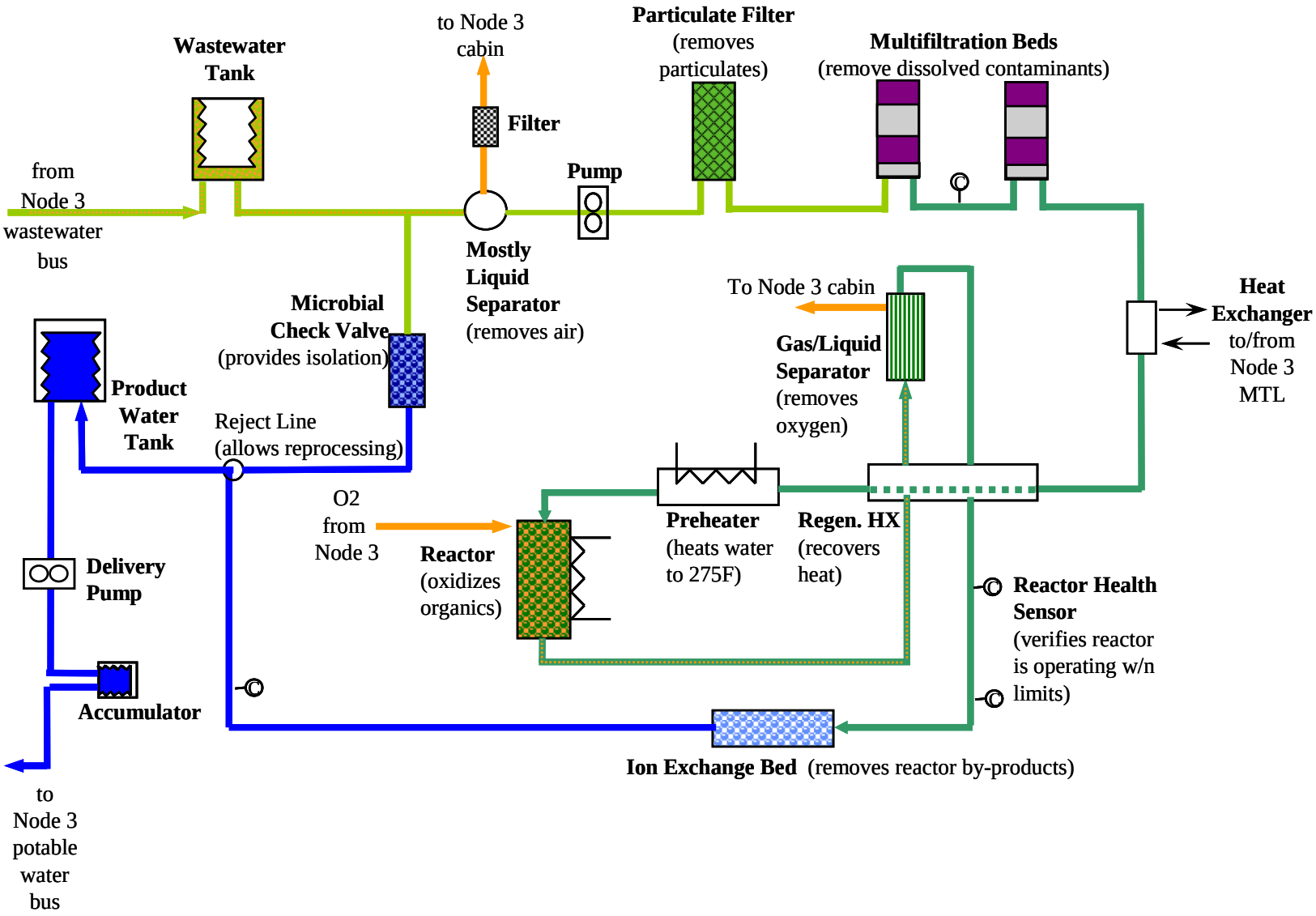


# Background

- Purpose: to find ways to form DMSD from larger siloxane compounds.
- Used breathing air and heat to see if DMSD would volatilize and ran scans with gold and platinum electrodes in siloxane compounds to see if there is a viable pathway on the ISS for DMSD formation
- Nasa is interested in this because DMSD has the potential to mask the presence of more toxic compounds.
- Relevance: astronauts will be exposed to the same conditions which could progress and become more of a threat


Water Recovery System (WRS)
USOS CABIN
CREW
BIOLOGICAL PAYLOADS
Urine
URINE PROCESSOR ASSEMBLY (UPA)
Distillate
Wastewater
WATER PROCESSOR ASSEMBLY (WPA)
Water
Potable water
Potable water
Oxygen Generation System (OGS)
OXYGEN GENERATOR ASSEMBLY (OGA)
Hydrogen
Sabatier
Power Supply Module (PSM)
Oxygen
Carbon Dioxide
overboard

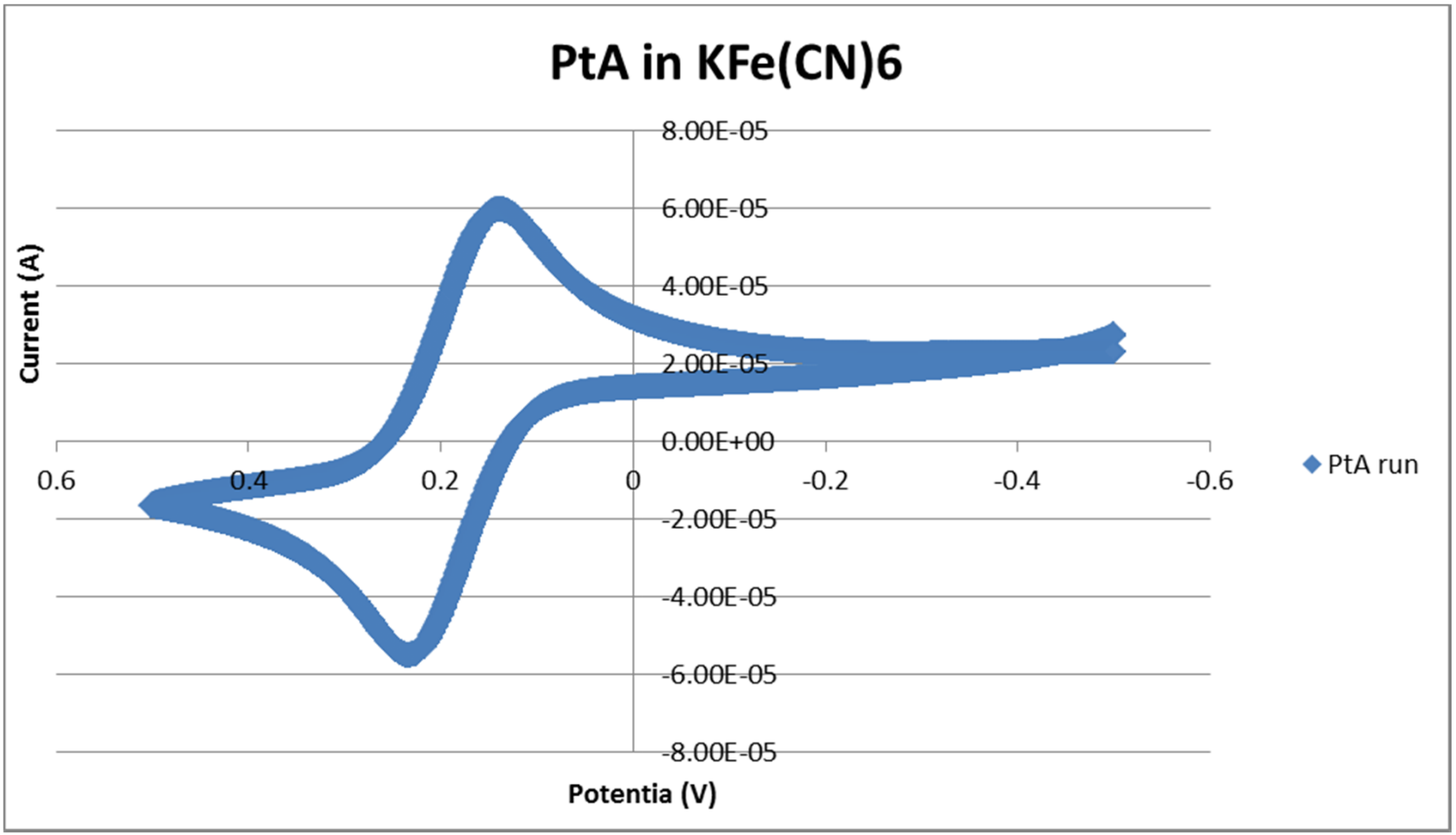
Space Life Sciences
Summer Institute



# Methods/Procedures or Skills

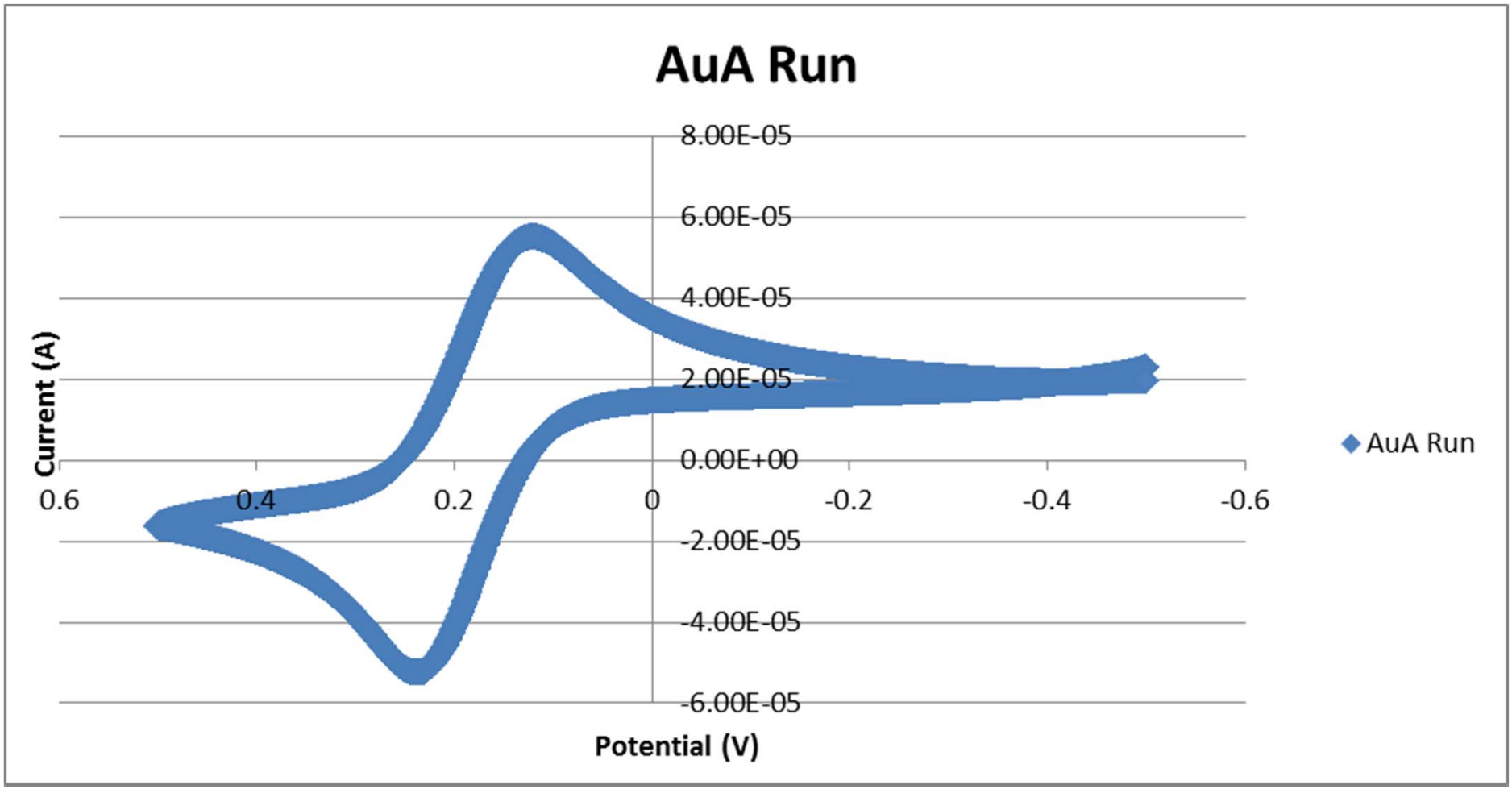
- Used DMSD solution under different conditions to test the volatility
- Used gold, silver, and platinum electrodes and tested each one and high and low intervals in KCL to find the potential range
- Ran each electrode in KFe(CN)6 to see the results against the background
- Ran each electrode in DMSD to see results against background
- Learned to use an electrochemical workstation, how to dilute solutions, proper identification of compounds, and how to interpret and understand graphs of an electrochemical workstation

# Results



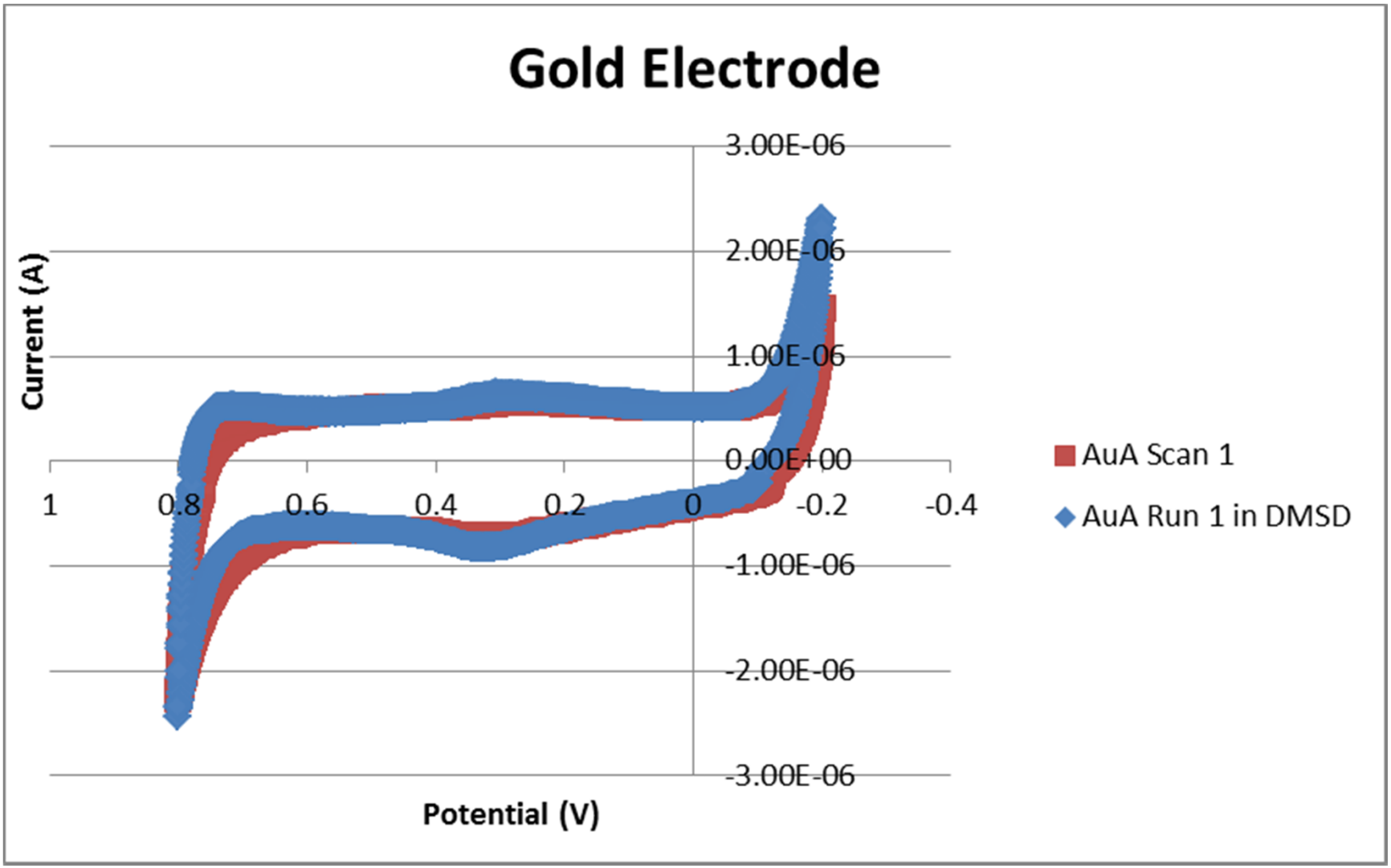

- Graph of platinum electrode in KFe(CN)6

# Results



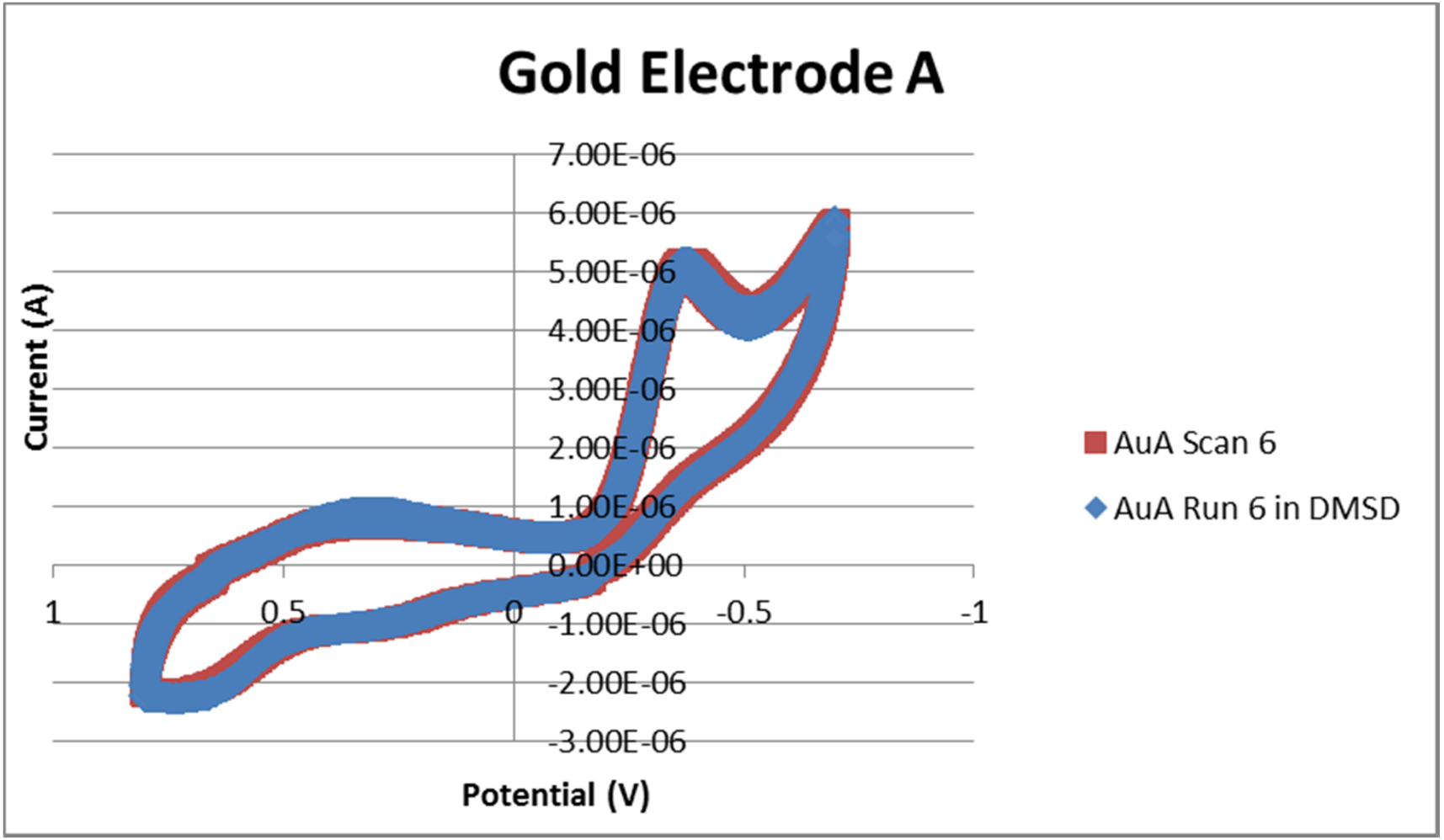

- Graph shows gold electrode in KFe(CN)6

# Results



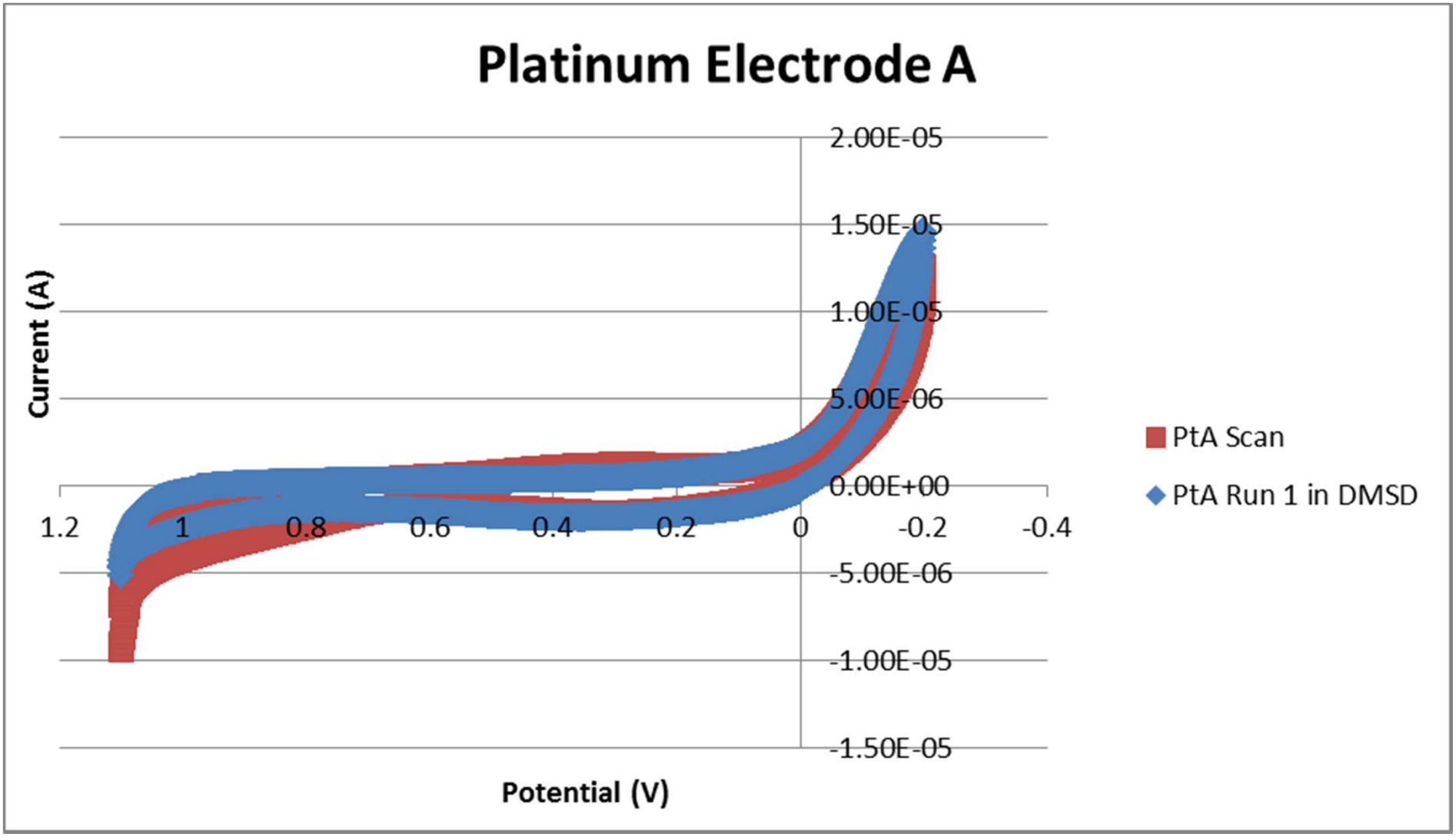

- Graph of the potential range of gold electrode A in .1 M KCl and scan in DMSD.

# Results



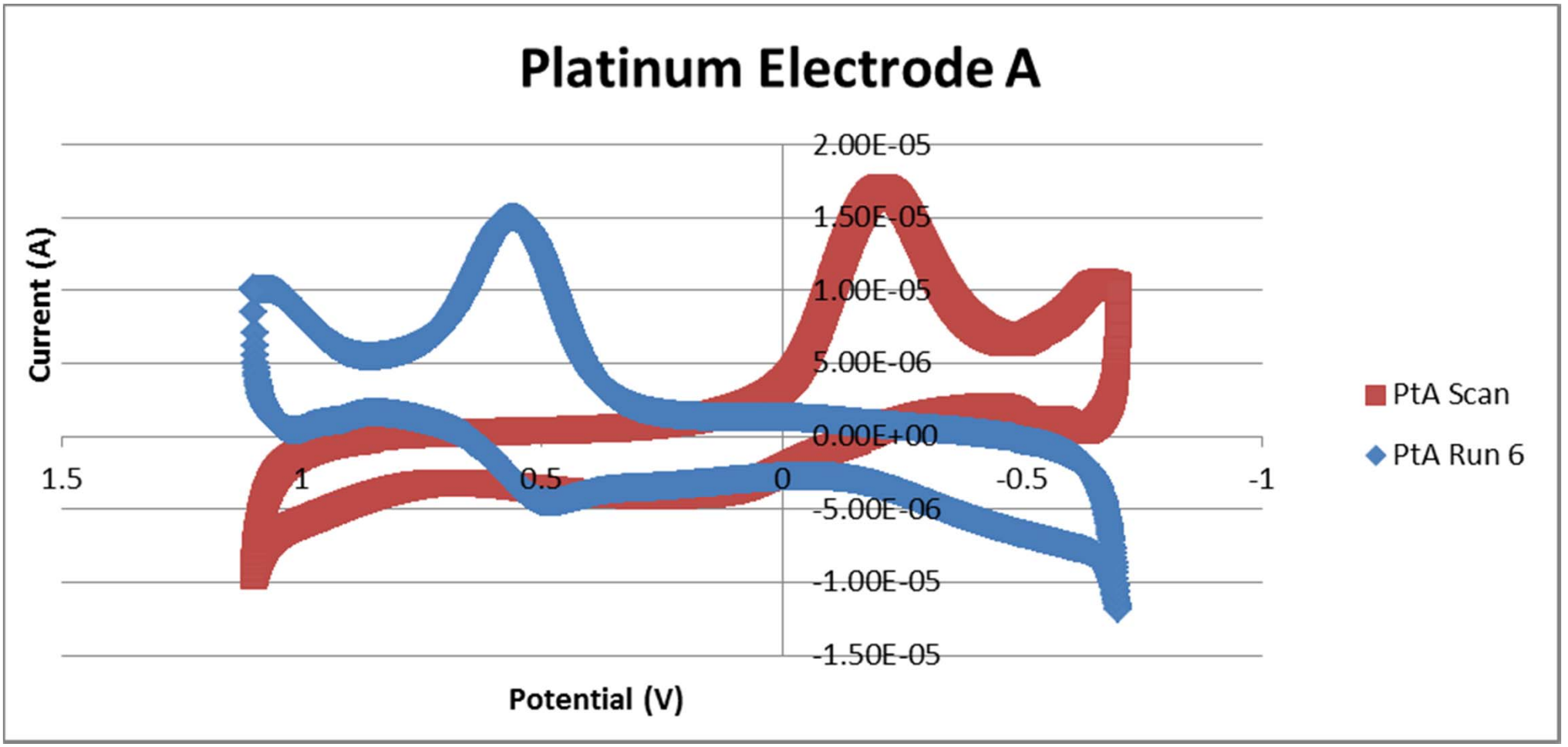

- Graph shows scan of gold electrode outside of potential range in DMSD against the background scan in .1M KCl.

# Results




- Graph of the potential range of platinum electrode A in .1 M KCl and scan in DMSD.

# Results




- Graph shows the scan of the platinum electrode in DMSD against the background scan in .1M KCl.

# Results

**DMSD Volatility**

| DESCRIPTION | SAMPLE DATE | Initial Solute Volume mg/L | Final Solute Volume mg/L | Actual Conc. mg/L | Theoretical Conc. mg/L | Percent Yield |
|---|---|---|---|---|---|---|
| 48 ppm DMSD stock solution | 06/17/2013 | 5 | 5 | 48 | 48.00 | 100.00 |
| DI water blank | 06/17/2013 | 5 | 5 | <500 | / | / |
| (C1) t = 4 hrs | 06/17/2013 | 5 | 5 | 53 | 48.00 | 110.42 |
| (B1) t = 4 hrs | 06/17/2013 | 5 | 5 | 54 | 48.00 | 112.50 |
| (A1) t = 4 hrs | 06/17/2013 | 5 | 5 | 49 | 48.00 | 102.08 |
| (C2) t = 5 hrs | 06/17/2013 | 5 | 4.2 | 61 | 57.14 | 106.75 |
| (C3) t = 5 hrs | 06/17/2013 | 5 | 4.4 | 57 | 54.55 | 104.50 |
| (B2) t = 24 hrs | 06/18/2013 | 5 | 3.6 | 68 | 66.67 | 102.00 |
| (A2) t = 24 hrs | 06/18/2013 | 5 | 5 | 50 | 48.00 | 104.17 |
| (B3) t = 48 hrs | 06/19/2013 | 5 | 2.3 | 120 | 104.35 | 115.00 |
| (A3) t = 48 hrs | 06/19/2013 | 5 | 4.6 | 55 | 52.17 | 105.42 |
| (B4) t = 72 hrs | 06/20/2013 | 5 | 0.8 | 320 | 300.00 | 106.67 |
| (A4) t = 72 hrs | 06/20/2013 | 5 | 4.4 | 58 | 54.55 | 106.33 |
| (B5) t = 72 hrs | 06/20/2013 | 5 | 0.5 | 400 | 480.00 | 83.33 |
| (A5) t = 1 week | 06/24/2013 | 5 | 3.8 | 68 | 63.16 | 107.67 |

A: ambient temp.; B: heat only; C:heat and purge gas

5 controls for each condition

Chart shows the volatility concentration and percent yield of 48 ppm DMSD solution.

# Discussion

- Learned that it is unlikely that DMSD will volatilize on the ISS.
- Contributions to NASA’s knowledge: it is not a harmful substance
- Information can be used to find source of DMSD and ways to stop its formation and create better environment for future astronauts

# Life Outside of NASA


- Barbequed for the holidays

# Life Outside of NASA

- Meet and greet with local alumni chapter

# Acknowledgements


- Dr. Daniel Gazda
- Dr. Mike Kuo
- William Wallace
- Brandon Taylor

ANY QUESTIONS??