Glow Discharge Calorimetry

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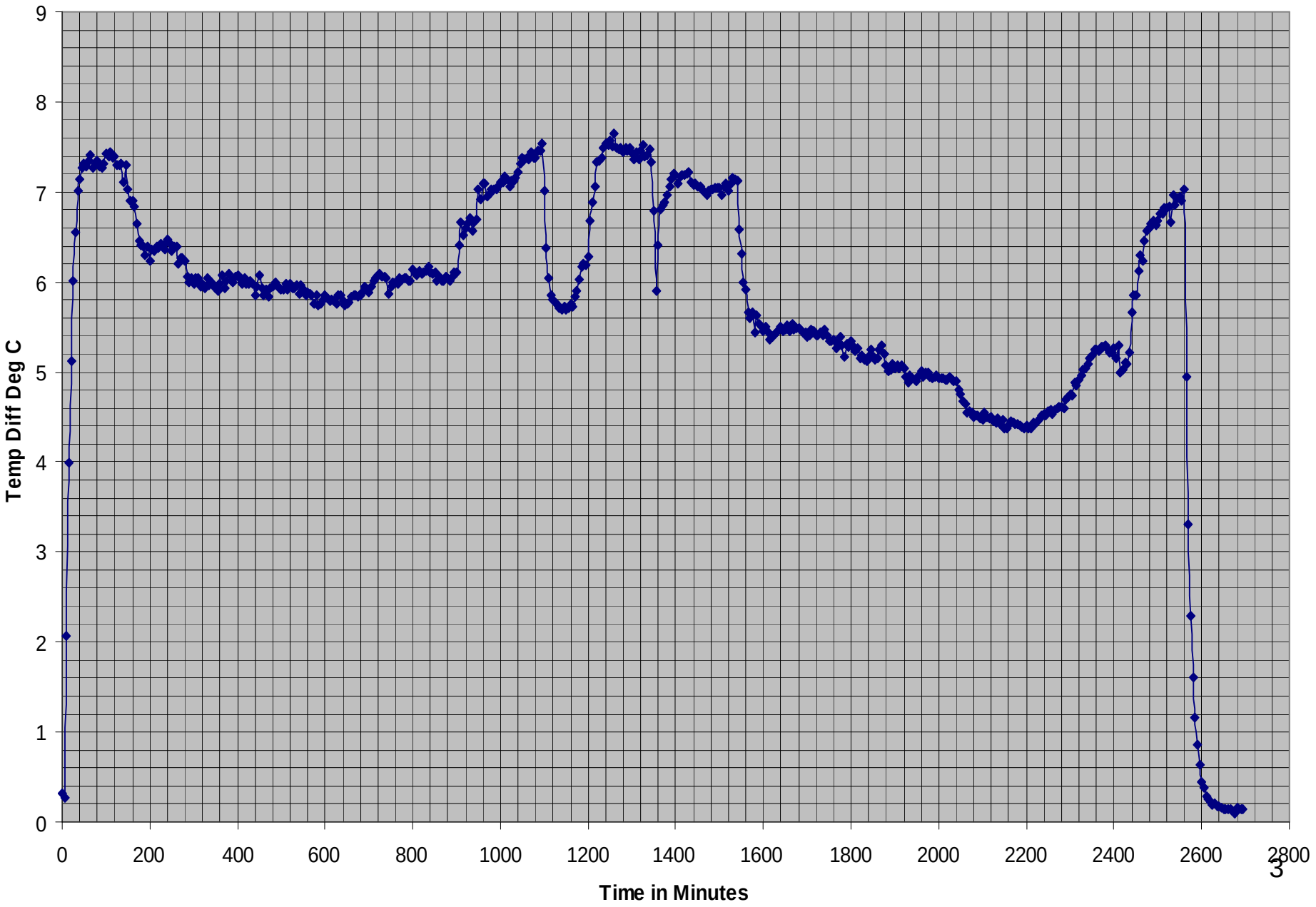
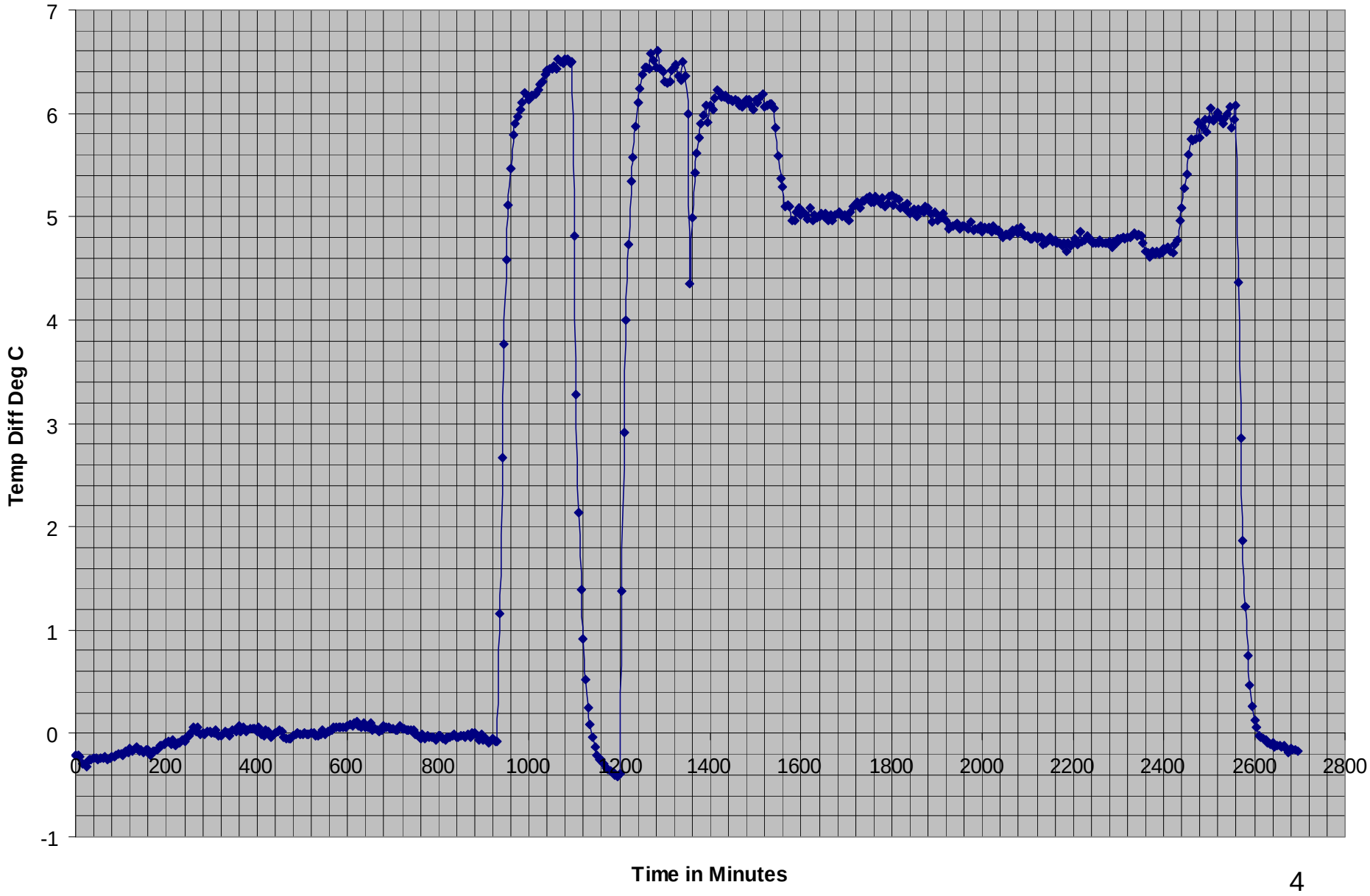
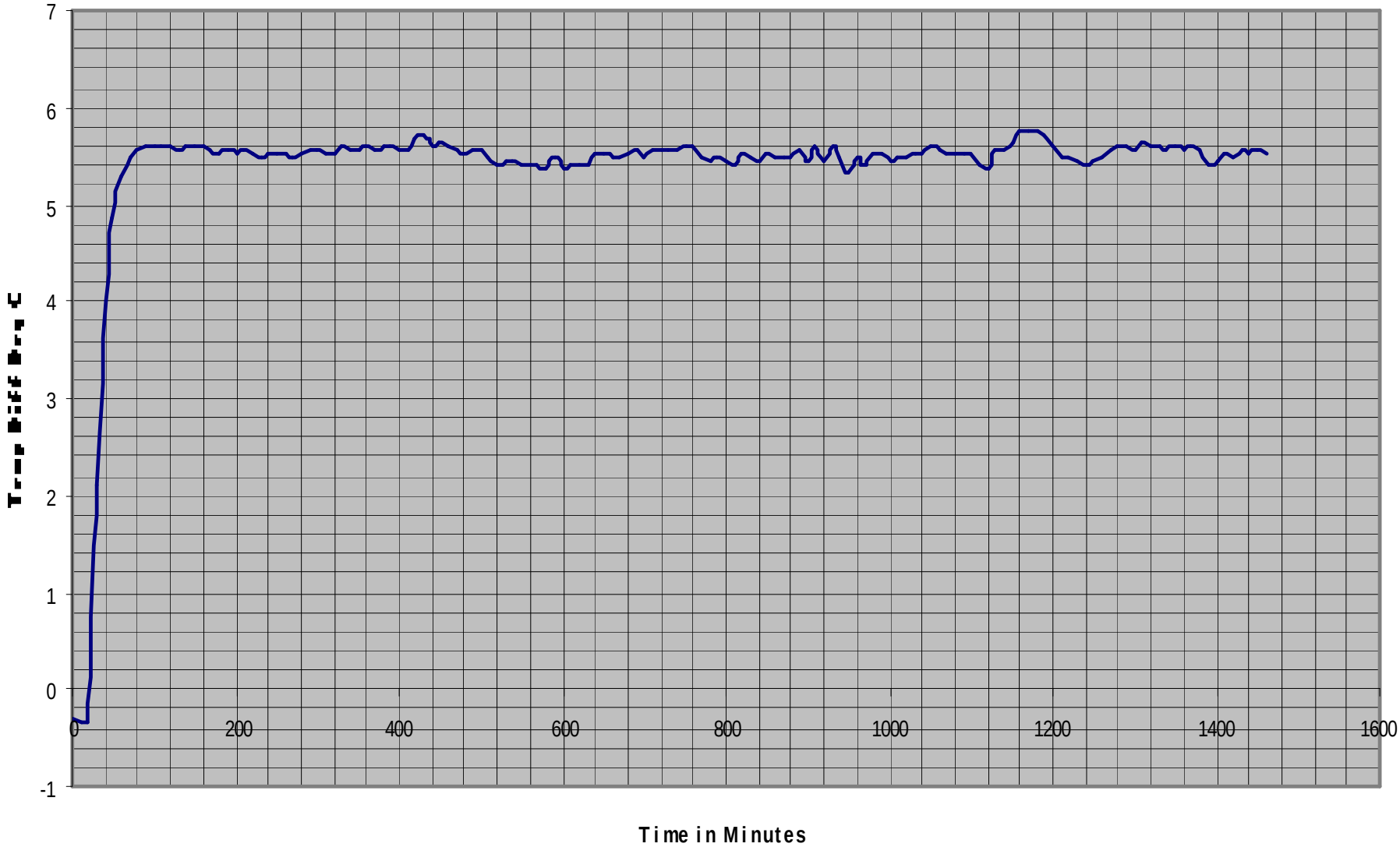
APPROACH

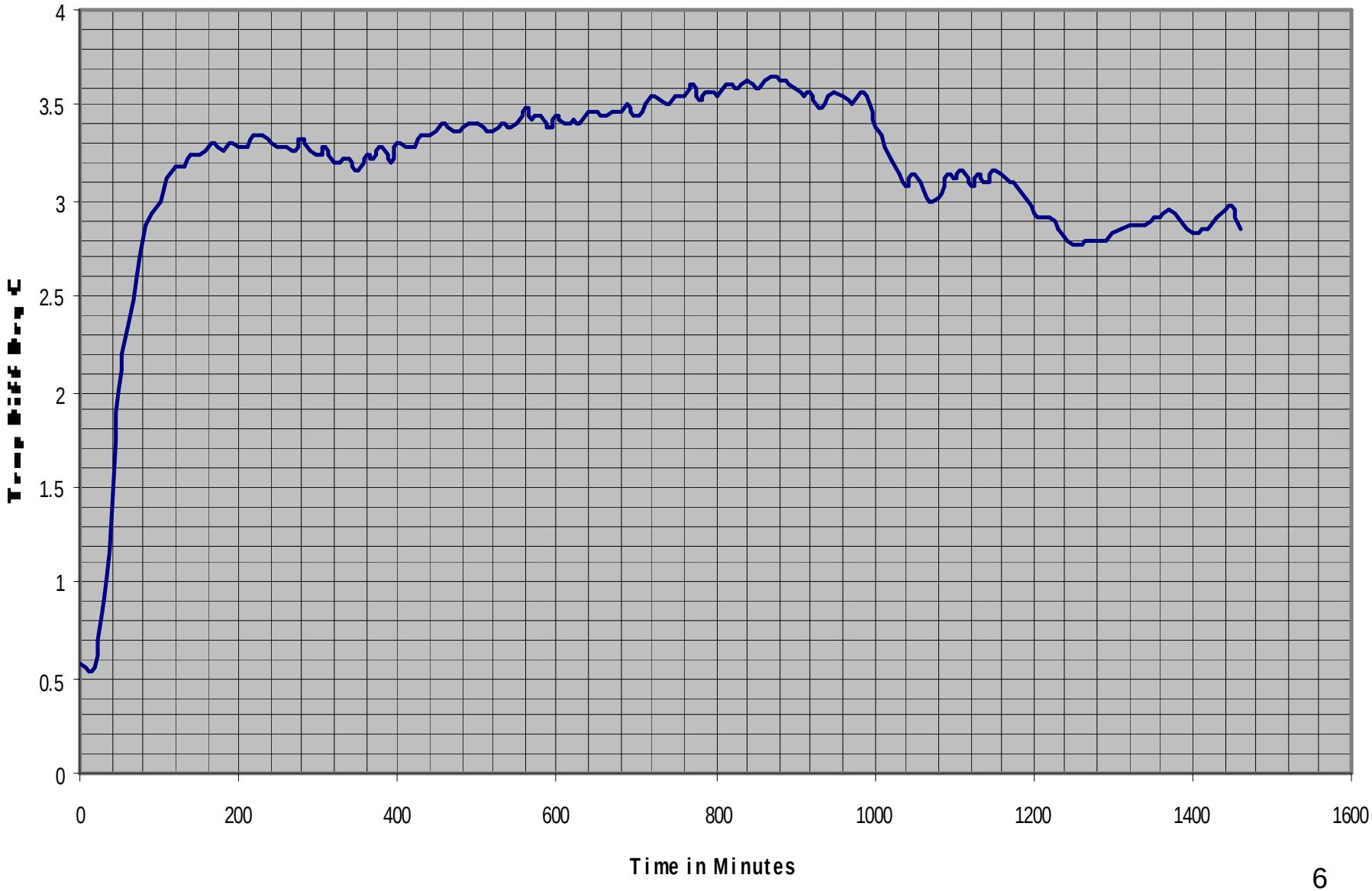
- Small Glow Discharge Tubes in Cylindrical Geometry Operated at ~1 watt Input Power on D2, H2, or Argon, The Latter for Baseline XSH
- Many Pairs of Metal Surfaces on the Center and Cylindrical Electrodes
- Eight Tubes Operated in Parallel at 2 to 6 Torr Using Bleed Flow from 1-Liter Ballast Tanks for Seamless Gas Changes From a Common Gas Manifold
- Thermistor Temp Monitoring Via 40-Channel Multimeter
- Resistance Heating for Calibration
- Glass Port for Viewing Discharge and Optical Spectroscop
- Calorimetry on Power Supplies Determines Their Waste Heat and Hence Efficiency


Tube 12 - Ambient 04151705
Temp Diff Deg C
0
1
2
3
4
5
6
7
8
9
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
Time in Minutes


Tube 6 - Ambient 0415705
Temp Diff Deg C
7
6
5
4
3
2
1
0
-1
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
Time in Minutes

Tube 6 - 132 Ambient 042105

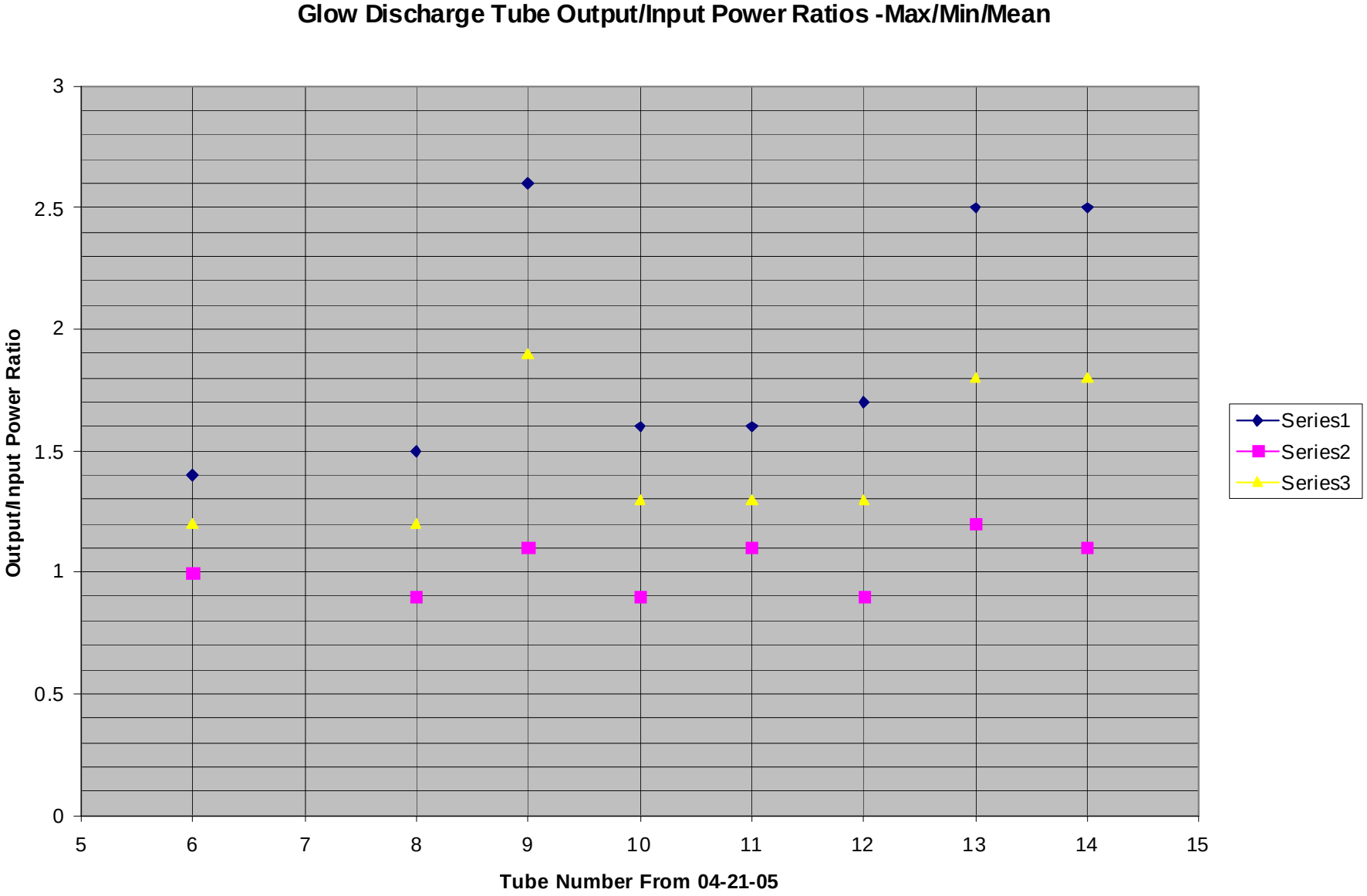



Pwr Supply 4 Tube 6 - 132 Ambient 042105
4
3.5
3
2.5
2
1.5
1
0.5
0
0
200
400
600
800
1000
1200
1400
1600
Time in Minutes

Problems

- Proper Calibration with Resistive Heating – Heat Must Enter System Similar to Heat From the Discharge
- Difficult to Capture Heat Generated at the Center Electrode –Especially Important When We Choose to Make it the Cathode

- Bleed Flow Must Exceed Background Gases from Air In-Leakage and Outgassing of Surfaces and Stored H2 or D2 Release from Pd
- Discharge Stability Must Exceed the Thermal Time Constants for Achieving Thermal Equilibrium –Typically 40 to 120 minutes
- Large Ratios (>2) of Excess Heat over Input Still Detectable in Spite of Problems


Glow Discharge Tube Output/Input Power Ratios -Max/Min/Mean
Output/Input Power Ratio
3
2.5
2
1.5
1
0.5
0
5
6
7
8
9
10
11
12
13
14
15
Tube Number From 04-21-05
Series1
Series2
Series3

CONCLUSIONS

- With Fine Tuning This System Should be able to Screen Many Combinations of Metals and Surface Structures on the Electrodes
- The Tubes are Inexpensive and Appear to Maintain Discharges for Several 10’s of Hours Unattended
- Obtaining High Surface Area Electrodes is the Next Step