**Introduction**

- The paper drying process is energy-intensive, contributing to 12% of total energy used in manufacturing.
- The DOE proposes a smart paper dryer using three new drying technologies to reduce the overall energy consumption by 25%. This research investigates moisture detection methods using terahertz (THz) radiation to be used within the smart dryer.

**Objective:** Modify experimental setup for reliable measurements to relate the Percent of Power Transmitted (PPT) through paper to its relative Dry Basis Moisture Content (rDBMC).

**Power Transmitted and Reflection Through Paper**

**Setup:**
1. Two Face Transmission
   - Paper began to crinkle as it dried, causing gradual increases and decreases in the voltage.
2. Two Off-Axis Parabolic (OAP) Mirrors and Scale
   - Paper was lying flat on the scale, which led to delamination and gradual increases and decreases in the voltage.
3. Four Off-Axis Parabolic Mirrors and Scale

**Results and Conclusion**

Two stages of paper drying:
1. ≥ 20% rDBMC, free water evaporates
2. < 20% rDBMC, associated water evaporates

**Equation Fit:**

- **a. two sigmoid functions**
  
  \[ f(x) = \begin{cases} 
  94.87 \pm 0.0233 & (0.171 \pm 0.0077)x - 0.045 \pm 0.008x^2 \\
  293.3 \pm 13.57 & 1 + \exp \left( -31.81 \pm 13.78x \right) 
  \end{cases} \]

  | x ≥ 20% |

- **b. exponential function in the first stage and a 3rd degree polynomial in the second stage**

  \[ f(x) = \begin{cases} 
  94.18 \pm 0.3385 & (0.171 \pm 0.0077)x - 0.045 \pm 0.008x^2 \\
  279.2 \pm 13.78 & 1 + \exp \left( -31.81 \pm 13.78x \right) 
  \end{cases} \]

  | x ≥ 20% |

In either case, there is a strong correlation between rDBMC and PPT which will aid in the creation of a mathematical model and the implementation of a smart paper dryer.

**Future Directions:**

- Investigate the effect of the sample’s orientation, and the effect of the room’s humidity and temperature on the PPT and the rDBMC.
- Measure the reflected and transmitted power simultaneously.

**Acknowledgements**

We would like to thank WPI for sponsoring the REU for Developing a Clean Energy Future. Sincere thanks to Professor Douglas Petkie and Jacob Bouchard for helping and encouraging us in our research.