NORTHERN ARIZONA UNIVERSITY
College of Engineering, Forestry & Natural Sciences

Solar Irradiance Measuring Device

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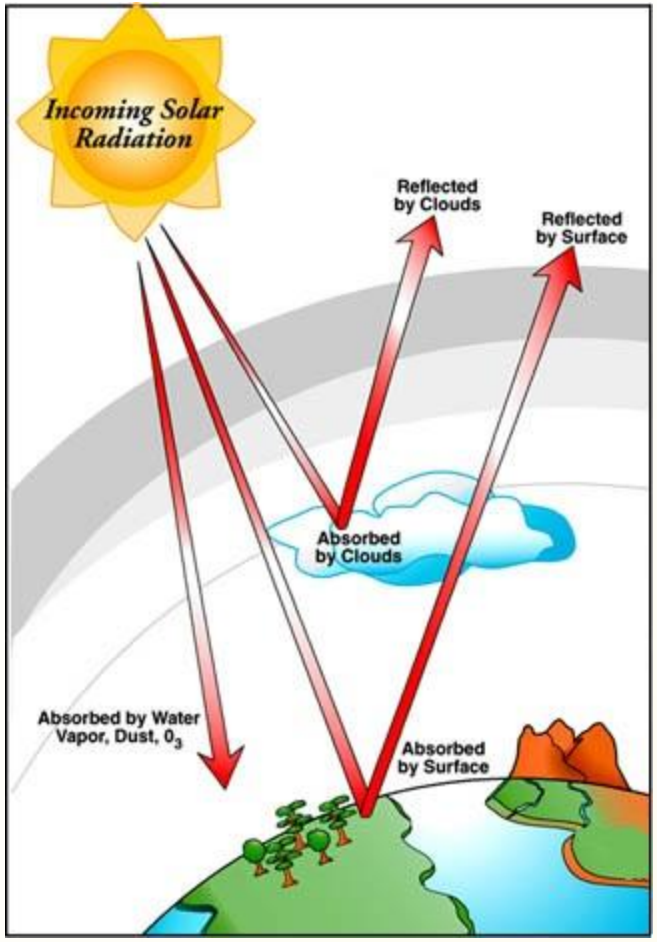
Overview

- Background
- Design Analysis
- Data Analysis
- Future Plans
- Timeline
- References

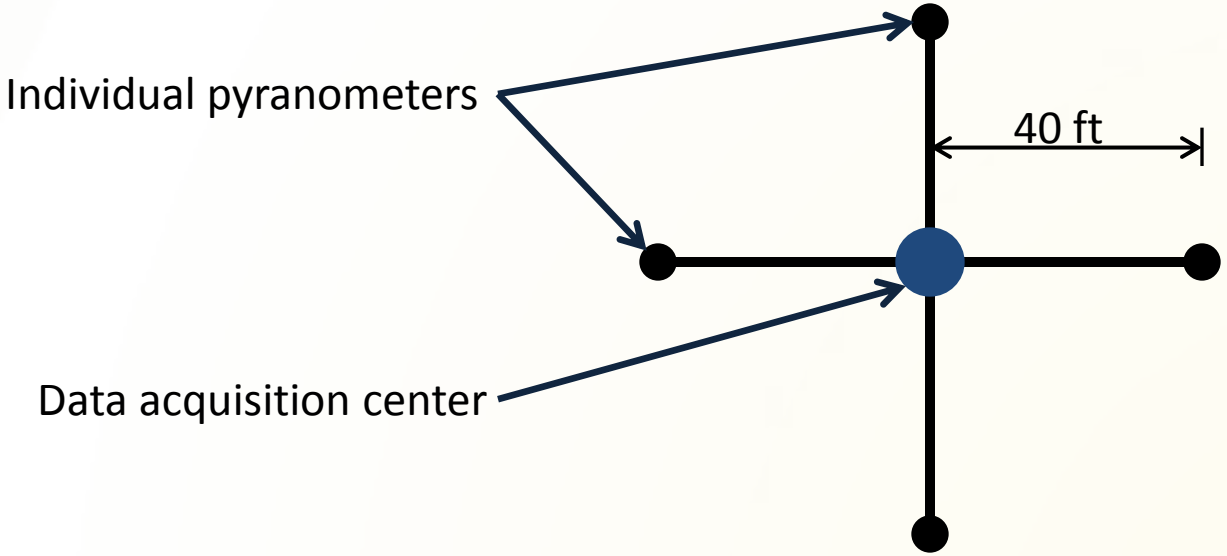
Background

- Located at COBar Ranch
- 1 square mile
- 50 sensors
- Variance data used to determine viability of solar site
- Changes with weather
  - Inconsistent output



Proposed Site

- **5 pyranometers**
- **One centralized data acquisition center**
- **Approximate radius of 40 feet**



Tripod

- Tripod mounted Pyranometers
- Tripod Stability
  - Stakes
  - Expansion bolts
  - Sand Bags
- Galvanized Steel
  - Longevity

Pyranometer Interface

- **User friendly in the field**
  - **Leveling**
  - **Mounting**
  - **Longevity**

Tripod Interface

- Manufacturing
  - Extruded Aluminum
  - Cost Effective
- Single U-bolt Mount
  - Zinc Plated Steel
- Provides a Leveling Base

Data Acquisition

- **Li-Cor LI-200 Pyranometer**
  - Compatible with Campbell Scientific Data Logger
  - Average Error < 5%

- **Campbell Scientific CR-800**
  - Proven in industry
  - Max sampling rate: 100Hz

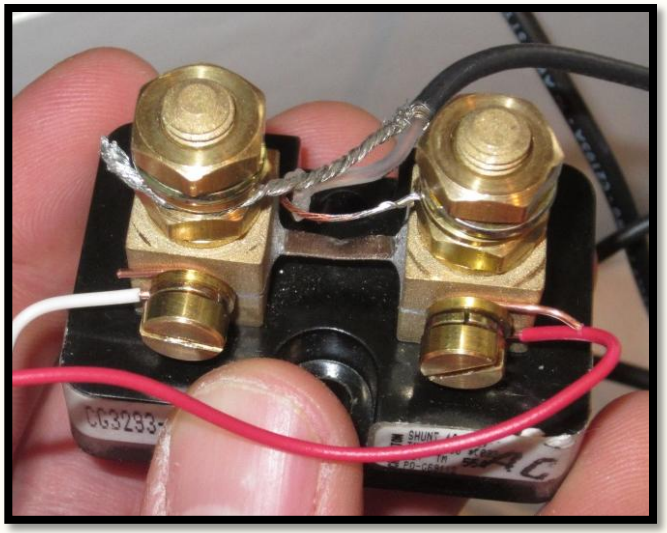
- **Loggernet**
  - Datalogger interface program

Data Transfer

- **Pyranometer Wiring:**
  - **Simple setup**
  - **Negligible voltage drop**
- **Wires will be housed in flexible conduit**
- **Protects wires from**
  - **Cows**
  - **Rodents (eg. field mice)**
  - **Ultra violet rays**
  - **Water**

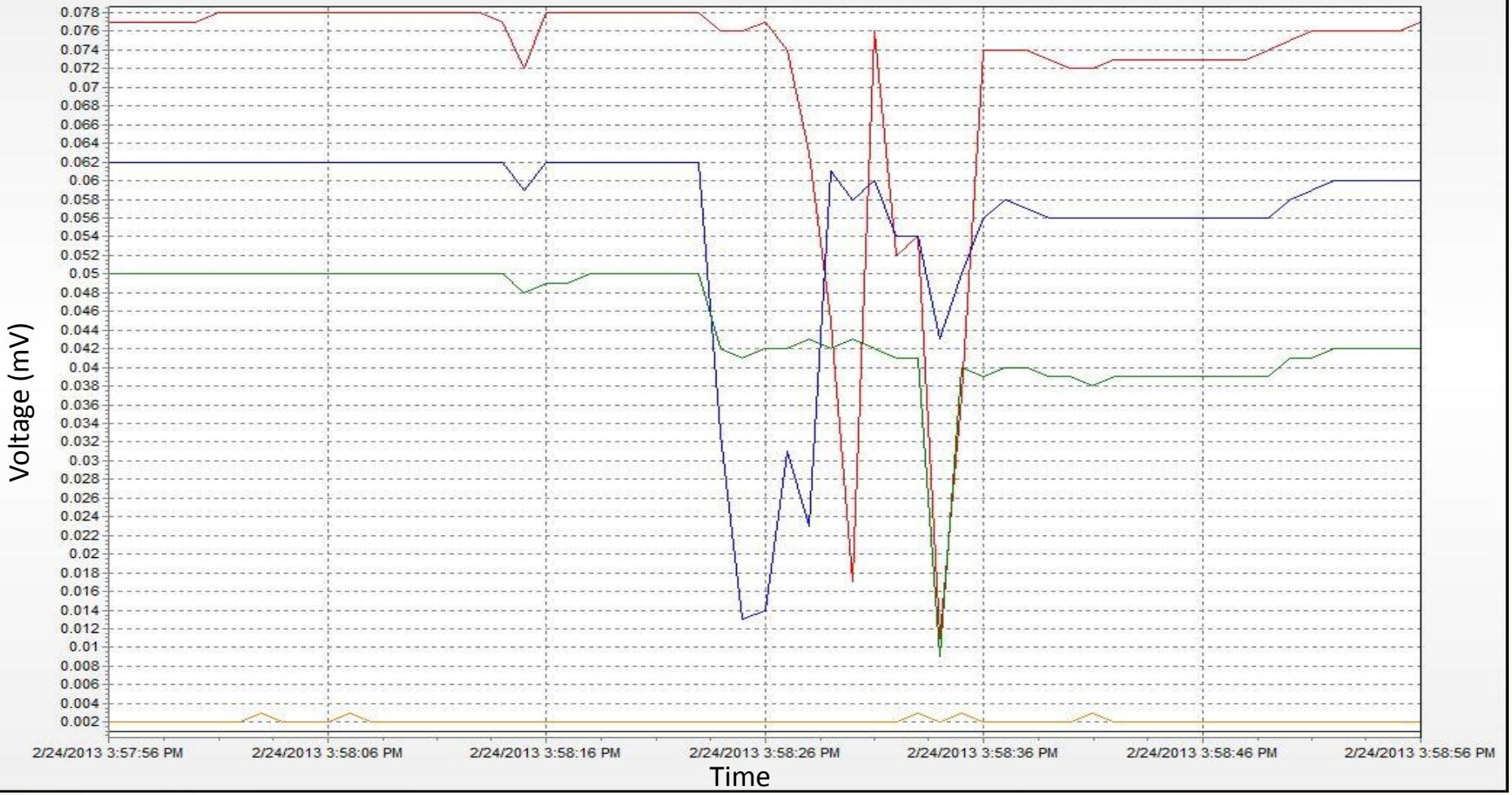
Datalogger Wiring

- Pyranometers wired as single ended voltage measurement
- Shunt resistors used to measure potential difference
- Four need calibration
- New sensor used as the standard

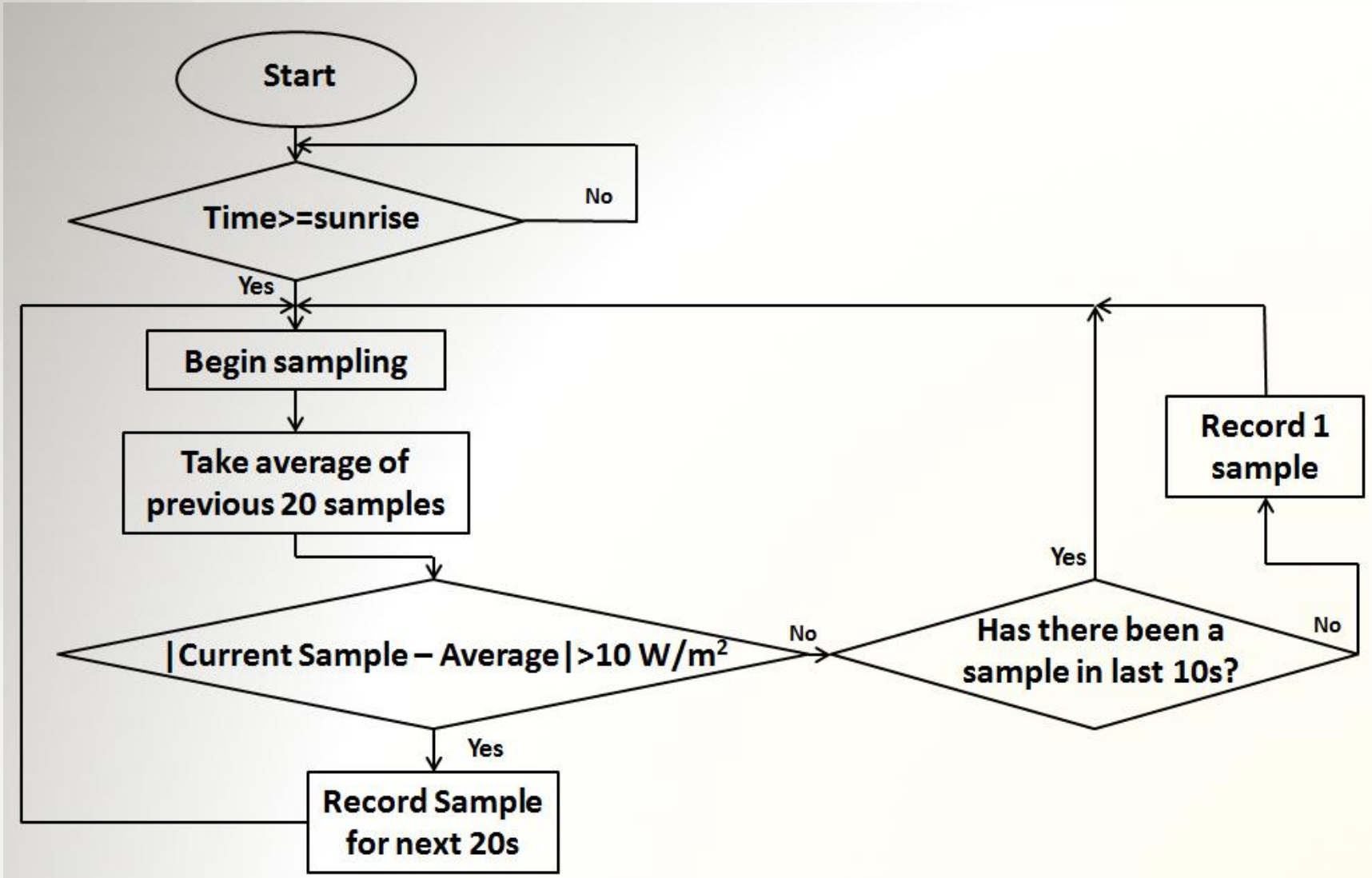


Temporary Shunt Resistor

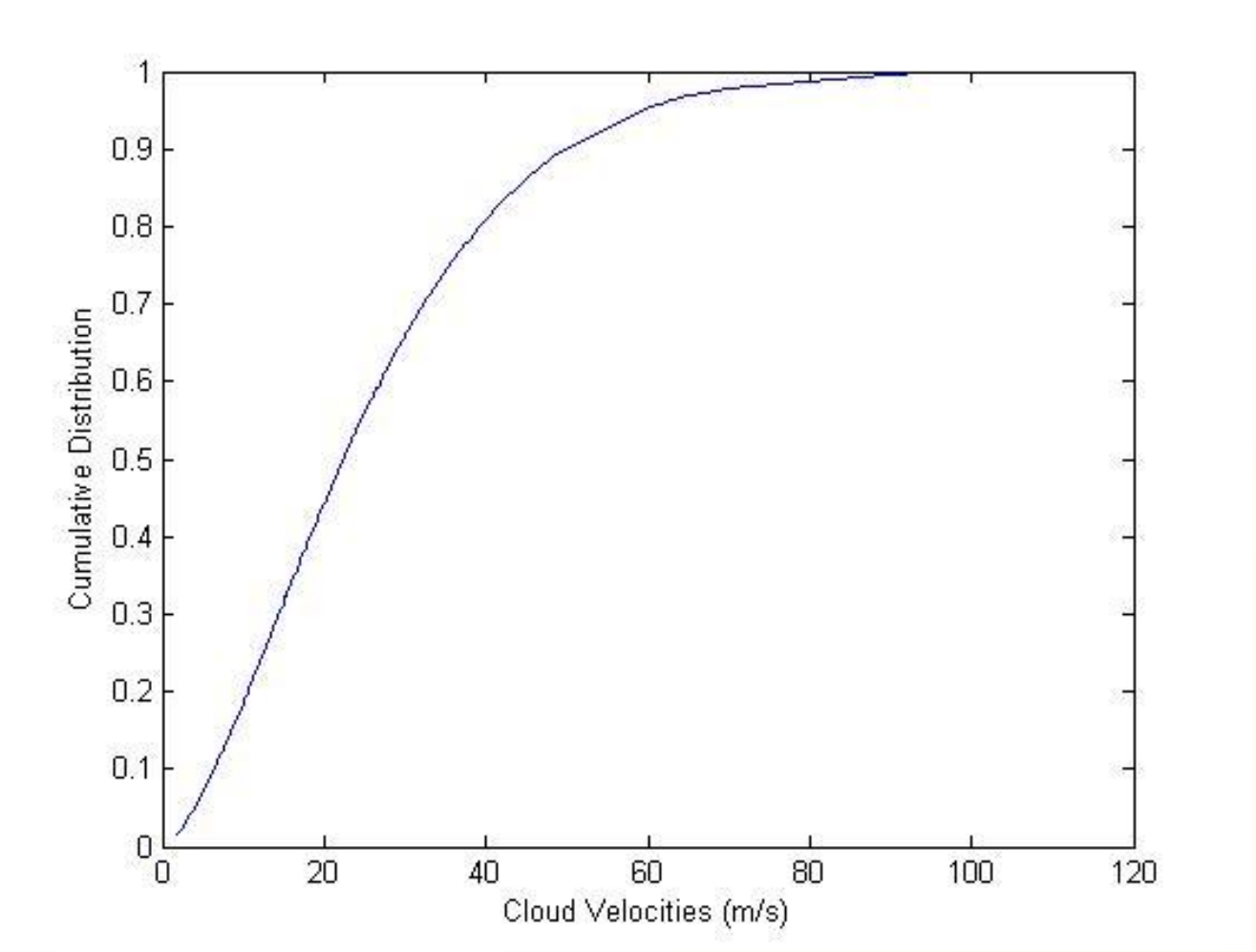
Pyranometer Outputs



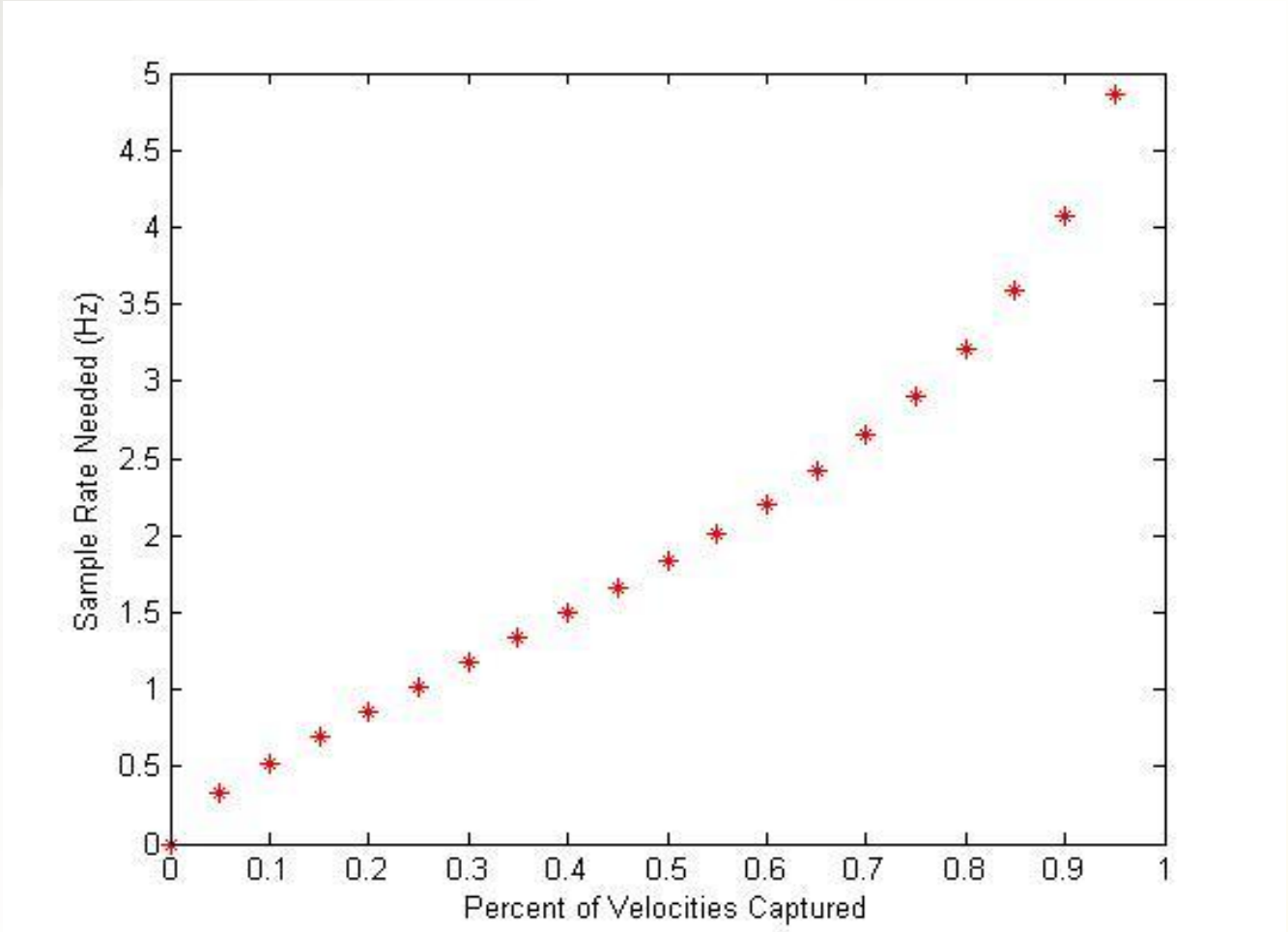
Datalogger Flowchart



Cumulative Distribution



Frequencies Needed



Frequencies Needed

Percent of Cloud Events Seen	Hz Needed
0.8	3.21132
0.85	3.58319
0.9	4.07677
0.95	4.85806
1	Inf

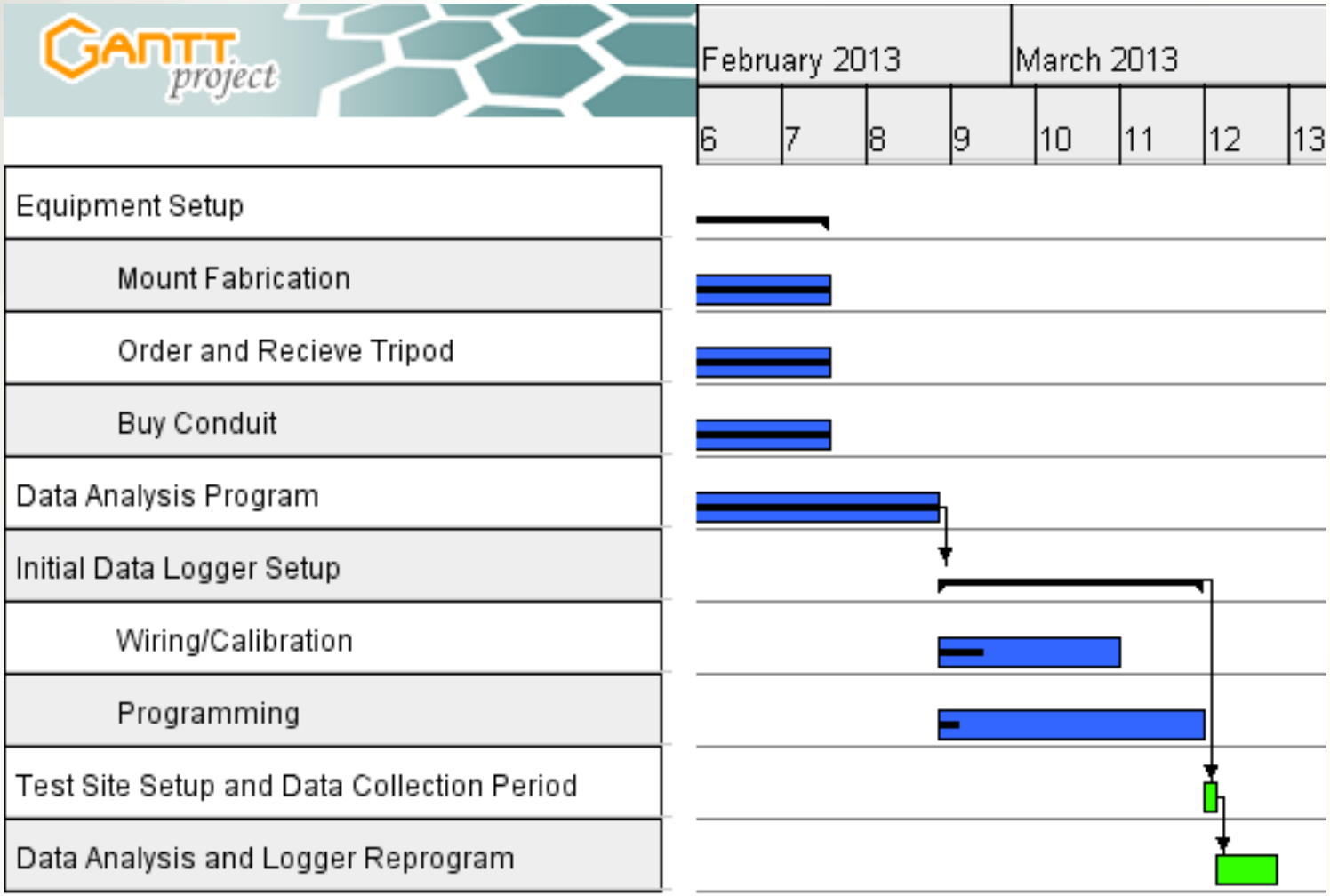
Cost Analysis

	Quantity	Approximate Cost
Campbell Scientific CR800	1	$ 1,395.00
LI-COR LI 200 Sensors	5	$ 1,128.00
T Posts - 8ft	4	$ 21.00
Tripod	1	$ 71.17
Conduit	200ft	$ 76.36
Misc. Hardware	-	
Aluminum Sheet	1 (4 ½ x 1 ¾)	$13.12
Nuts and Bolts	7	$4.18
USB Cable	1	$41.58
Total		**$2,750.41**

Future Plans

- Programming and data analysis
  - Research wind/cloud movement behavior
  - Implement logic diagram
- Hardware components
  - Determine pyranometer calibration values
  - Extend wiring to 50 feet
  - Solder new shunt resistors on leads
- Construct new site

Timeline


GANTT project
February 2013
March 2013
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Equipment Setup
Mount Fabrication
Order and Recieve Tripod
Buy Conduit
Data Analysis Program
Initial Data Logger Setup
Wiring/Calibration
Programming
Test Site Setup and Data Collection Period
Data Analysis and Logger Reprogram

Resources

- Twidell, John, and Weir, Tony. *Renewable Energy Resources*. New York: Taylor and Francis Group, 2006.
- www.envcoglobal.com/taxonomy/term/685/0
- "Prevailing Wind Direction." *Http://www.wrcc.dri.edu/*. N.p., n.d. Web. 03 Nov. 2012. <http://www.wrcc.dri.edu/htmlfiles/westwinddir.html>
- Flood, Ronald K., Dr. Tom Acker, and David Willy. *Prescott Airport Solar Facility Solar Variability Study*. Tech. N.p.: n.p., n.d. Print.

Questions