SAND2016-7295PE

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Sandia National Laboratories

Our STAR Internship

Stephen Danos

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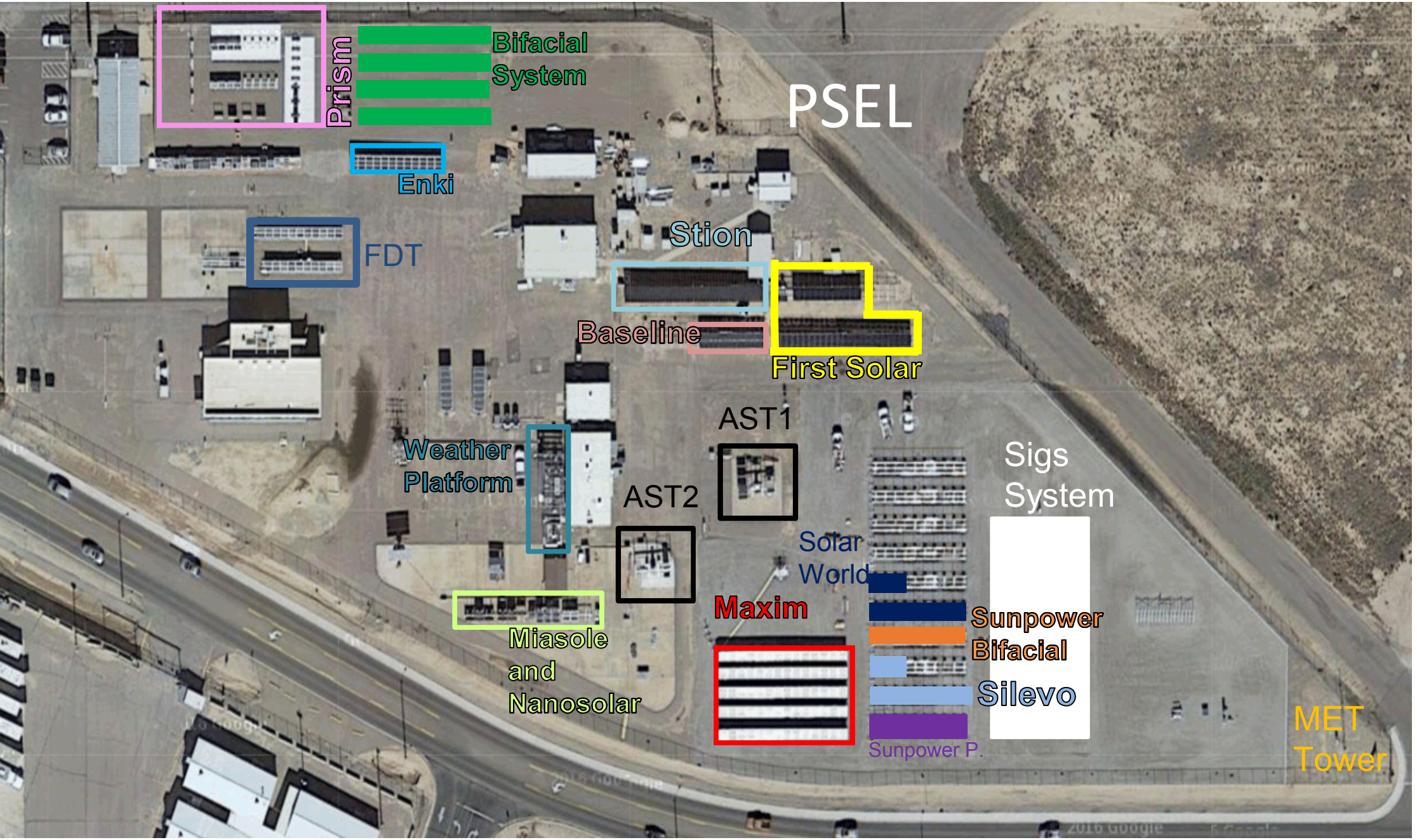
U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration | LOCKHEED MARTIN

Week 1

- Intro to PSEL (Photovoltaic Systems Evaluation Laboratory)

  -PV Systems

  -PSEL Site
- Intro to PVDMS (Photovoltaic Data Management System)



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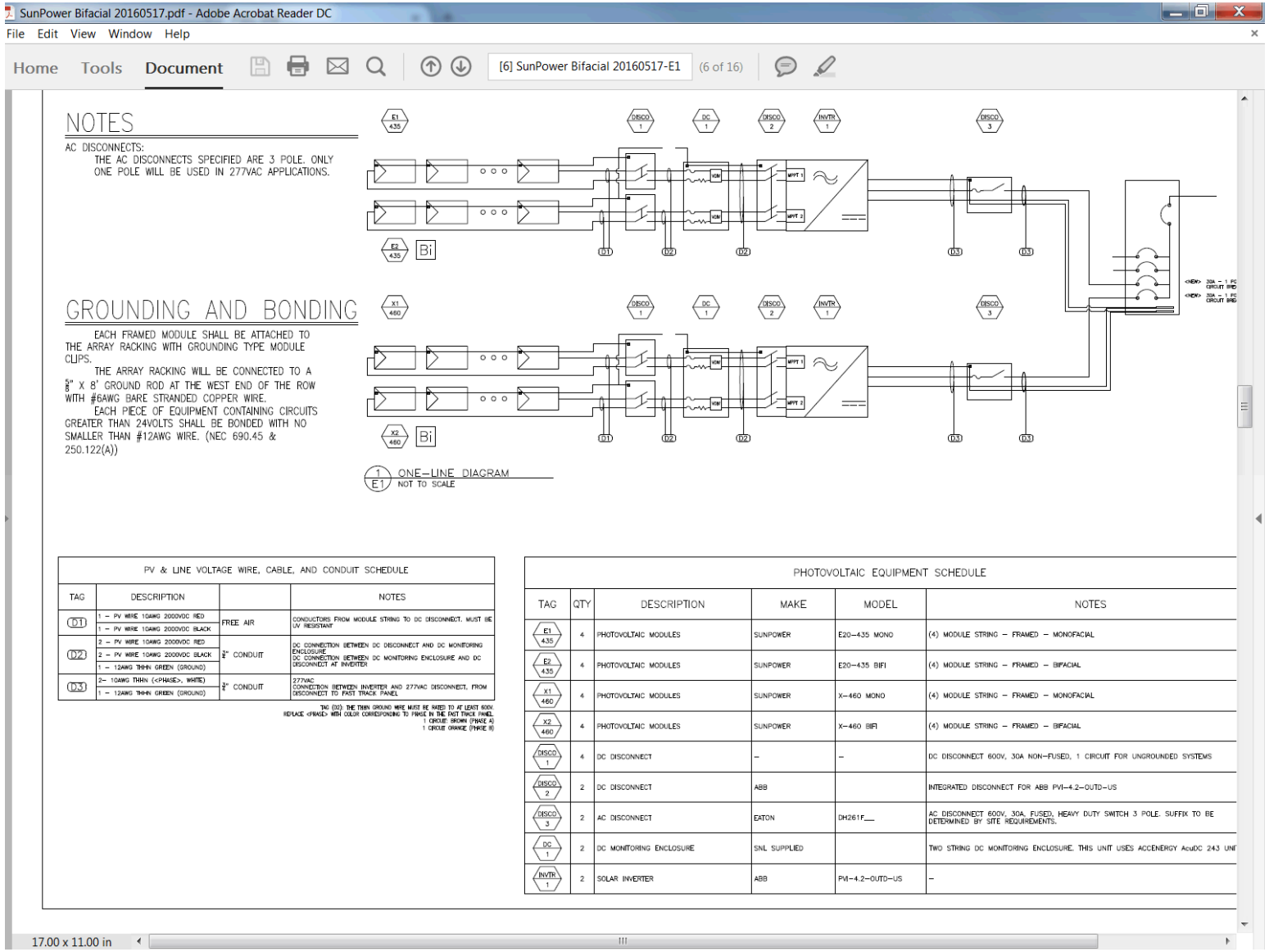
Week 2-3

- Cataloging Systems in PVDMS

  -Map out PV systems.

  -Enter layout into PVDMS.



PV System Configuration

Status: Development
Version: 1

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- **NM RTC SunPower Bifacial**
  - **DAQ** - Campbell Scientific CR1000 (#1651/#NA)
    - **Disconnect** - Eaton AC Disconnect (#FTA10/#NA)
      - **Inverter** - String Inverter (#1351701948/#NA)
        - **Disconnect** - ABB Inverter DC Disconnect (#1348601196/#NA)
          - **Disconnect** - Eaton DC Disconnect (#X1/#NA)
            - **PV String** - X1
              - **Module** - X-Series Monofacial 128 Cell (#L50PESM006/3362)
                - **Thermocouple** - Thermo Couple (#2/#NA)
              - **Module** - X-Series Monofacial 128 Cell (#L50PESM009/3361)
              - **Module** - X-Series Monofacial 128 Cell (#L50PESM008/3363)
              - **Module** - X-Series Monofacial 128 Cell (#L50PESM007/3359)
                - **Thermocouple** - Thermo Couple (#1/#NA)
          - **Disconnect** - Eaton DC Disconnect (#X2/#NA)
            - **PV String** - X2
              - **Module** - X-Series Bifacial 128 Cell (#L50PESB006/3374)
              - **Module** - X-Series Bifacial 128 Cell (#L50PESB010/3375)
                - **Thermocouple** - Thermo Couple (#3/#NA)
              - **Module** - X-Series Bifacial 128 Cell (#L50PESB007/3366)
                - **Thermocouple** - Thermo Couple (#4/#NA)
              - **Module** - X-Series Bifacial 128 Cell (#L50PESB008/3367)
    - **Disconnect** - Eaton AC Disconnect (#FTA-11/#NA)
      - **Inverter** - String Inverter (#1345434929/#NA)
        - **Disconnect** - ABB Inverter DC Disconnect (#1343345204/#NA)
          - **Disconnect** - Eaton DC Disconnect (#E1/#NA)
            - **PV String** - E1
              - **Module** - E-Series Monofacial 128 Cell (#L50PCWM003/3356)
              - **Module** - E-Series Monofacial 128 Cell (#L50PCWM002/3354)
                - **Thermocouple** - Thermo Couple (#5/#NA)
              - **Module** - E-Series Monofacial 128 Cell (#L50PCWM004/3355)
              - **Module** - E-Series Monofacial 128 Cell (#L50PCWM001/3357)
                - **Thermocouple** - Thermo Couple (#6/#NA)
          - **Disconnect** - Eaton DC Disconnect (#E2/#NA)
            - **PV String** - E2
              - **Module** - E-Series Bifacial 128 Cell (#L50PCWB004/3373)
                - **Thermocouple** - Thermo Couple (#7/#NA)
              - **Module** - E-Series Bifacial 128 Cell (#L50PCWB002/3371)
              - **Module** - E-Series Bifacial 128 Cell (#L50PCWB001/3370)
                - **Thermocouple** - Thermo Couple (#8/#NA)
              - **Module** - E-Series Bifacial 128 Cell (#L50PCWB003/3372)

DAQ Calculated Values

Signal Label	Value	Unit Of Measure

DAQ Channels and Associated Sensors

DAQ Module Model	DAQ Module SN#
M7019R	SunPowerBifacial2
M7019R	SunPowerBifacial1

Rack Information

Rack Name	Rows	Columns	Module Count
Fast_Track_Row_4	2	8	16

Commission System | Decommission System

Back | View Details | Create Asset | Export Configuration | Bill of Materials

Week 4-5

- Re-Ap

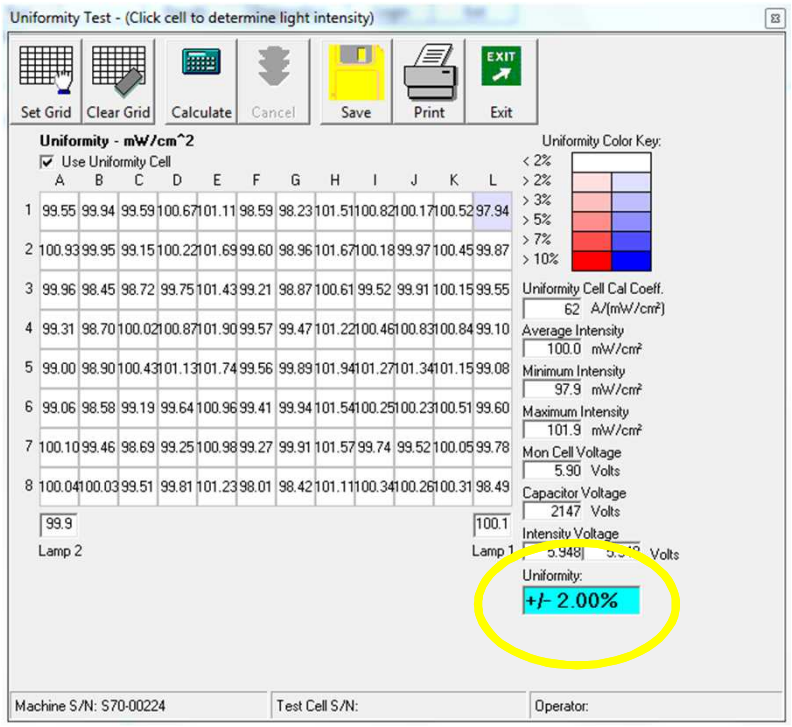
  -Index unused and obsolete tools/devices for reapplication.

Stephen's Last Weeks

- Spatial Non-Uniformity Mapping
  - Calibrating the Spire Flash Tester
- Instrument Cleaning

Spatial Non-Uniformity Mapping

To keep an AAA class simulator rating, the results of the test have to be within a 2% range



PSEL Instrument Cleaning

Instruments:

- ATS Modules
- Radiometer
- Albodometer
- Modules
- Reference cells
- Soiling Station

Julian’s Last weeks

- Database querying with PHP and MySQL
- Mapping with Highmaps API

  -Create the map with Inkscape

  -Edit map with JSON
- Placing a JSON map into an html website.

Database Querying

Get This

Command Prompt - mysql -u julgarc -p

```
MariaDB [solar]> describe baseline;
+----------------------+------------+------+-----+---------+-------+
| Field                | Type       | Null | Key | Default | Extra |
+----------------------+------------+------+-----+---------+-------+
| index                | bigint(20) | YES  | MUL | NULL    |       |
| Datetime             | datetime   | YES  |     | NULL    |       |
| ICP7019_1CJCTemp_Avg | double     | YES  |     | NULL    |       |
| ICP7019_2CJCTemp_Avg | double     | YES  |     | NULL    |       |
| ICP7019_3CJCTemp_Avg | double     | YES  |     | NULL    |       |
| ICP7019_4CJCTemp_Avg | double     | YES  |     | NULL    |       |
| ICP7019_5CJCTemp_Avg | double     | YES  |     | NULL    |       |
| ICP7019_6CJCTemp_Avg | double     | YES  |     | NULL    |       |
| ICP7019_7CJCTemp_Avg | double     | YES  |     | NULL    |       |
| LocalAmbientTemp_Avg | double     | YES  |     | NULL    |       |
| ModTemp10_Avg        | double     | YES  |     | NULL    |       |
| ModTemp11_Avg        | double     | YES  |     | NULL    |       |
| ModTemp12_Avg        | double     | YES  |     | NULL    |       |
| ModTemp13_Avg        | double     | YES  |     | NULL    |       |
| ModTemp14_Avg        | double     | YES  |     | NULL    |       |
| ModTemp15_Avg        | double     | YES  |     | NULL    |       |
| ModTemp16_Avg        | double     | YES  |     | NULL    |       |
| ModTemp1_Avg         | double     | YES  |     | NULL    |       |
| ModTemp2_Avg         | double     | YES  |     | NULL    |       |
| ModTemp3_Avg         | double     | YES  |     | NULL    |       |
| ModTemp4_Avg         | double     | YES  |     | NULL    |       |
| ModTemp5_Avg         | double     | YES  |     | NULL    |       |
| ModTemp6_Avg         | double     | YES  |     | NULL    |       |
| ModTemp7_Avg         | double     | YES  |     | NULL    |       |
| ModTemp8_Avg         | double     | YES  |     | NULL    |       |
| ModTemp9_Avg         | double     | YES  |     | NULL    |       |
| POAIrrad1_Avg        | double     | YES  |     | NULL    |       |
| RecNbr               | bigint(20) | YES  |     | NULL    |       |
| RefCell1Irrad_Avg    | double     | YES  |     | NULL    |       |
| RefCell1R_Avg        | double     | YES  |     | NULL    |       |
| RefCell1Temp_Avg     | double     | YES  |     | NULL    |       |
| RefCell2Irrad_Avg    | double     | YES  |     | NULL    |       |
| RefCell2R_Avg        | double     | YES  |     | NULL    |       |
| RefCell2Temp_Avg     | double     | YES  |     | NULL    |       |
| Sys1Frequency_Avg    | double     | YES  |     | NULL    |       |
| Sys1Iac_Avg          | double     | YES  |     | NULL    |       |
| Sys1PowerFactor_Avg  | double     | YES  |     | NULL    |       |
| Sys1Str1Idc_Avg      | double     | YES  |     | NULL    |       |
| Sys1Str2Idc_Avg      | double     | YES  |     | NULL    |       |
| Sys1VARac_Avg        | double     | YES  |     | NULL    |       |
| Sys1Vac_Avg          | double     | YES  |     | NULL    |       |
| Sys1Vdc_Avg          | double     | YES  |     | NULL    |       |
| Sys1Wac_Avg          | double     | YES  |     | NULL    |       |
| Sys2Frequency_Avg    | double     | YES  |     | NULL    |       |
```

Using this

File Edit Search View Encoding Language Settings Macro Run Plugins Window ?

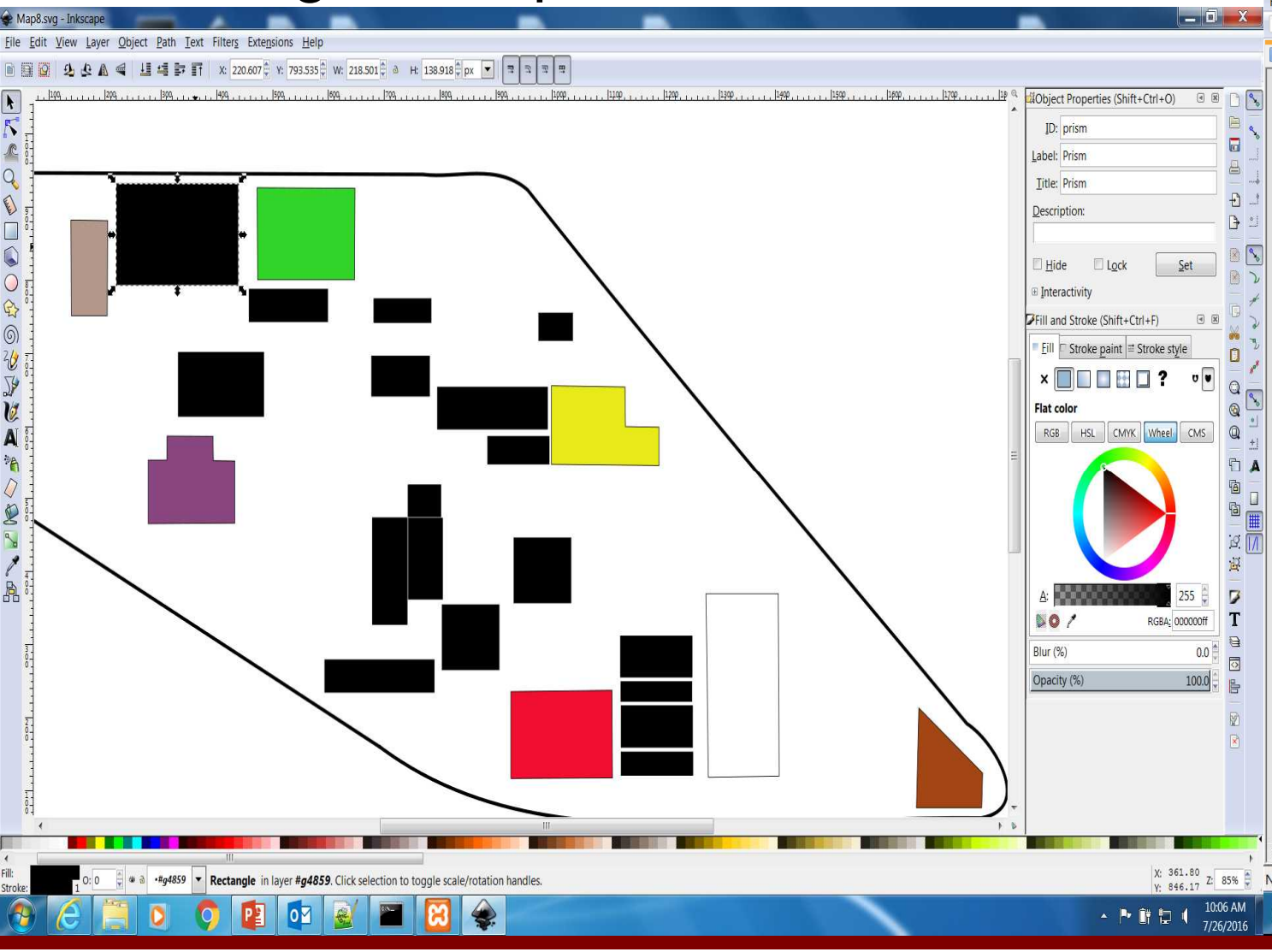
Map2.txt | index.php | Query.php

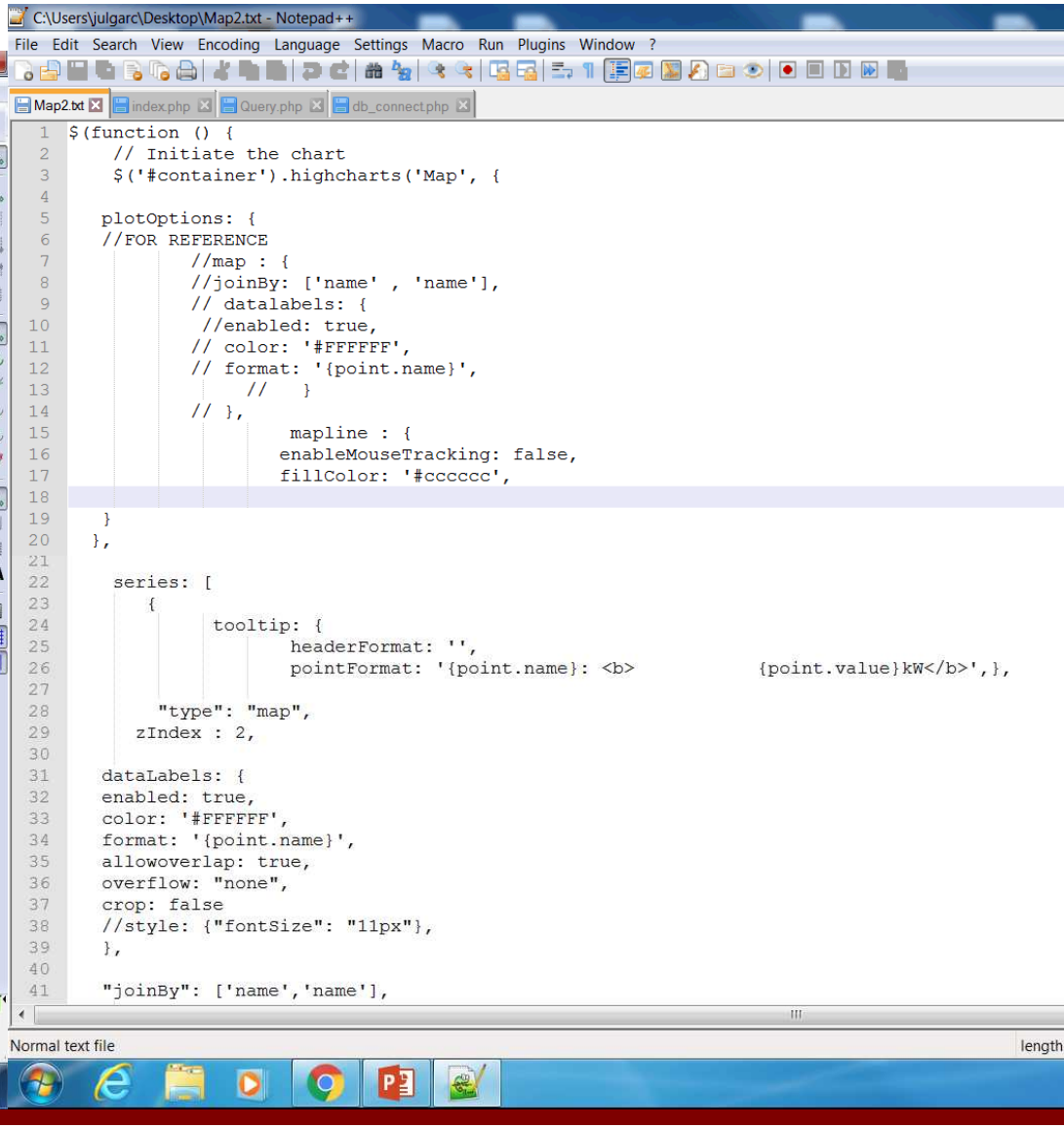
```php
<?php

$hostname = "localhost";
$username = "julgarc";
$password = "Julian";
$dbname = "example";

$conn = new mysqli($hostname, $username, $password, $dbname);
if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}
$sql = "SELECT * FROM example_1
WHERE datetime BETWEEN '2016-04-14 00:00:00' AND '2016-04-25 00:00:00' "

;
$result = $conn->query($sql);

$rows = array();
while($row = $result->fetch_assoc()) {
    echo "string: " . $row["string"];
    echo "\n";
    echo " temperature: " . $row["temperature"];
    echo "\n";
    echo " datetime: " . $row["datetime"];
    echo "\n";
    //$rows[] = $row["datetime"];
}

/*echo "\n";
echo $rows[0];
echo "\n";
*/
?>
```

PHP Hypertext Preprocessor file | length : 710

Mapping with Highmaps

1. Using Inkscape





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Your fiddle has an unsaved draft Settings Sign in

HTML

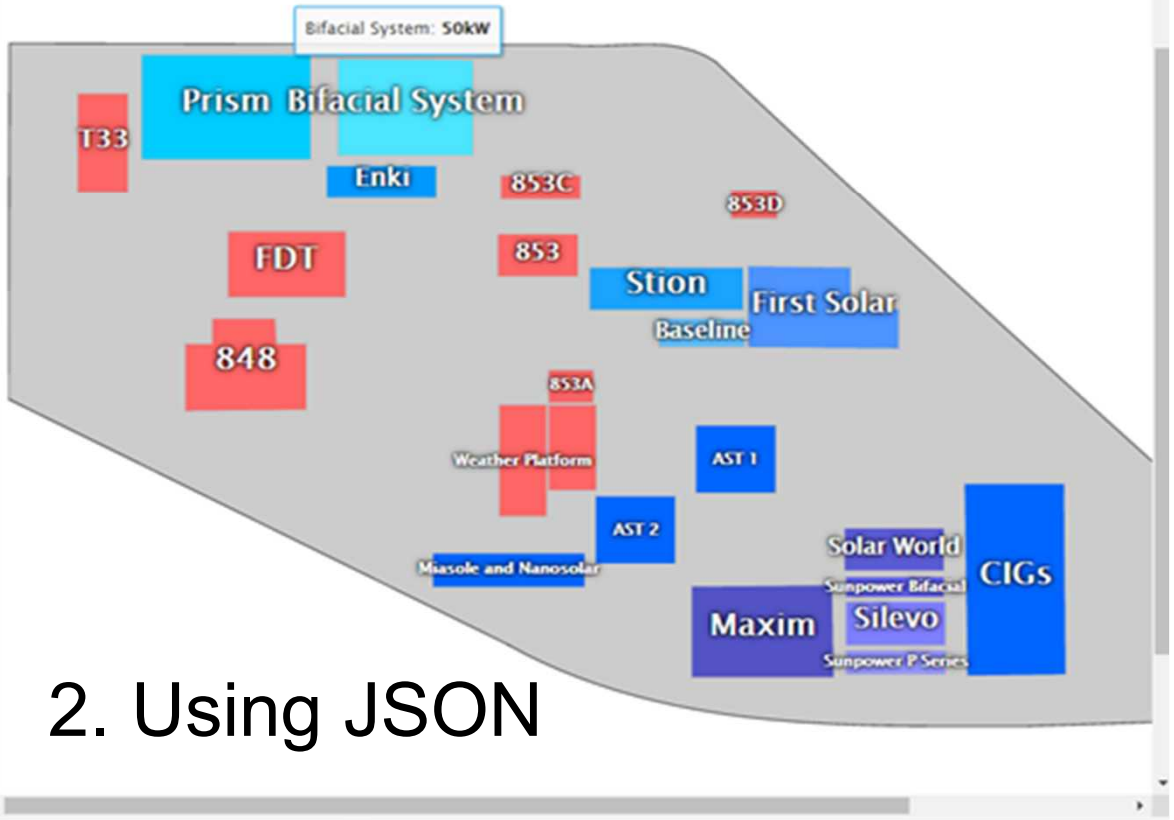
```
<script src="http://code.highcharts.com/maps/highmaps.js"></script>

<div id="container"></div>
```

CSS

```
#container {
  height: 800px;
  width: 1000px;
  margin: 0 auto;
}
.loading {
  margin-top: 10em;
  text-align: center;
  color: gray;
}
```

JAVASCRIPT

```
$(function () {
    // Initiate the chart
    $('#container').highcharts('Map', {

   plotOptions: {
   //FOR REFERENCE
           //map : {
           //joinBy: ['name' , 'name'],
           // datalabels: {
            //enabled: true,
           // color: '#FFFFFF',
           // format: '{point.name}',
            //   }
           // },
            mapline : {
                  enableMouseTracking: false,
                  fillColor: '#cccccc',

   }
  },

    series: [
     {
             tooltip: {
                    headerFormat: '',
                    pointFormat: '{point.name}: <b>       {point.value}kW</b>',},

      "type": "map",
      zIndex : 2,

   dataLabels: {
   enabled: true,
```



2. Using JSON

Placing the map