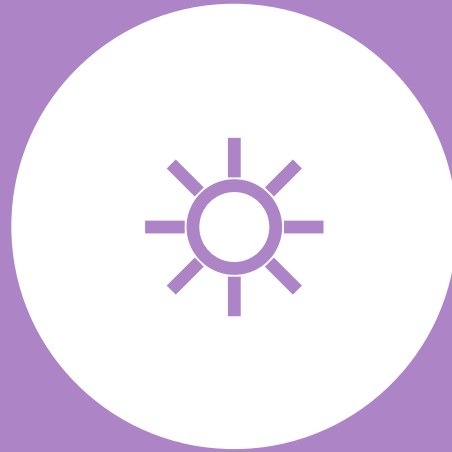




Solar Energy Laboratory Activities

Margarida Luís

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Lab work 1: Determination of the IV curve of a photovoltaic module

This laboratory task aims to study different electrical connections between PV modules by tracing the IV curve of one PV module and study the equivalent properties of the parallel and series association of two PV modules.

The following parameters should be determined:

- Short circuit current,
- Open circuit voltage,
- Maximum power,
- Fill factor,
- Efficiency,
- Characteristic resistance,
- Series resistance,
- Shunt resistance,
- Voltage thermal coefficient,
- Current thermal coefficient.



Lab work 1: Determination of the IV curve of a photovoltaic module

This laboratory task aims to study different electrical connections between PV modules by tracing the IV curve of one PV module and study the equivalent properties of the parallel and series association of two PV modules.

In addition, the shadowing effect for the previous 3 configurations is studied by measuring the short circuit current and the open circuit voltage when:

- A module is shadowed,
- A cell is shadowed,
- Half of a cell is shadowed.



Lab work 2: Determination of the working conditions and main characteristics of a charge controller

This laboratory task aims to study the performance of the charge controller under normal operation conditions as well as the thresholds for over-discharge and overcharge.

To test the normal operation conditions of a charge controller, a DC power supply should be used as a PV module, as well as a battery and a load (variable resistor), all connected via the charge controller.

The current and the voltage from PV module, batteries and load should be measured and the power should be calculated. This procedure should be done for the following conditions:

- PV on, load off,
- PV on, load on,
- PV off, load on.



Lab work 3: IV curves in real modules

This laboratory task aims to get a perception of the impact of shadowing on a solar module IV curve and its performance.

You should take IV curves with different shadowing patterns:

- No Shadow
- Vertical shadow at several coverage ratios (ex: 1:2, 1:4, 1:6), of the complete module
- Horizontal shadow at several coverage ratios (ex: 1:2, 1:4, 1:6), of the complete module

Bring a flashdrive/pen-drive for this activity!



Groups and useful information

- Divide into groups of 3 or 4 (depends on the total number of students)
- Send me the group (names and student numbers) to **miluis@ciencias.ulisboa.pt** until **Friday, October 2nd**
- I'll then let you know your group number and your lab work schedule

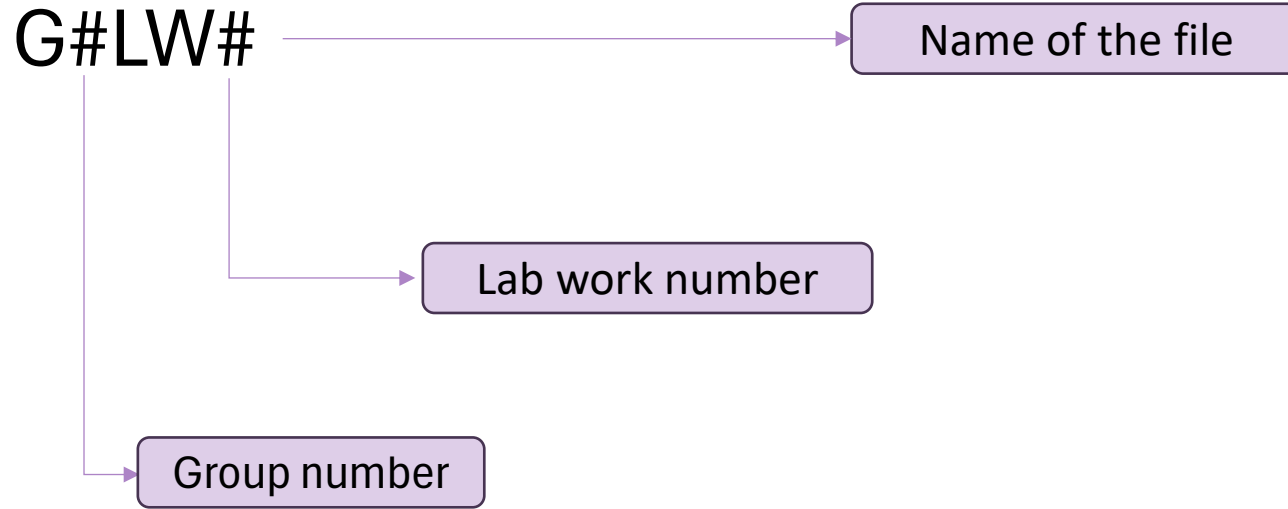


Where you can find me:

- Room 8.3.33
- miluis@ciencias.ulisboa.pt



Work delivery instructions



- Submit the first report in PDF and word formats within 2 weeks of the first lab work so I can provide constructive feedback before evaluation
- Reports should have a maximum of **10 pages**
- Reports to be submitted through Moodle
- Reports ideally should be delivered within 2 weeks of the lab work taking place
- All reports must be submitted by December 15th



How to write a **report** for an experimental activity

A report is not an experimental protocol

A report is the **description** of the experimental work, the **results** obtained in it, as well as the associated **ideas**, in order to constitute a complete and coherent compilation of everything related to that work.



How to write?

Simple, clear, objective and **precise** language.

Comply with **standards** in the writing of quantities and units and bibliographic standards

Concise and **coherent**, including the information essential for understanding the work.

All statements must be based on **results**, or **citations** from the literature.

Avoid too many **conclusions**, which are precise and synthetic.

The conclusions must be **consistent** with the results' discussion.

Report Structure



Front matter



Introduction



Methods



Results



Conclusions



References



Front matter



Introduction



Methods



Results



Conclusions



References

- Title
- Course
- Authors (including student number)
- Date





Front matter



Introduction



Methods



Results



Conclusions



References

- Include objectives of work
- 3-4 paragraphs
- Include relevant definitions
- Use (relevant) references





Front matter



Introduction



Methods



Results



Conclusions



References

- Description of materials
- Description of the methodology employed
- Must be detailed enough to allow replication.





Front matter



Introduction



Methods



Results



Conclusions



References

- Description of what was observed
- Includes data logging and calculations
- Whenever possible, present results in graph
- Do not repeat information in tables and graphs
- Pay attention to decimal points (and uncertainties)





Front matter



Introduction



Methods



Results



Conclusions



References

- Revisit work objectives
- Evaluation of results (compare with expected)
- Indicate justifications for possible deviations from the results
- Unforeseen results must be explained
- Suggest changes to the procedure and/or future work





Front matter



Introduction



Methods



Results



Conclusions

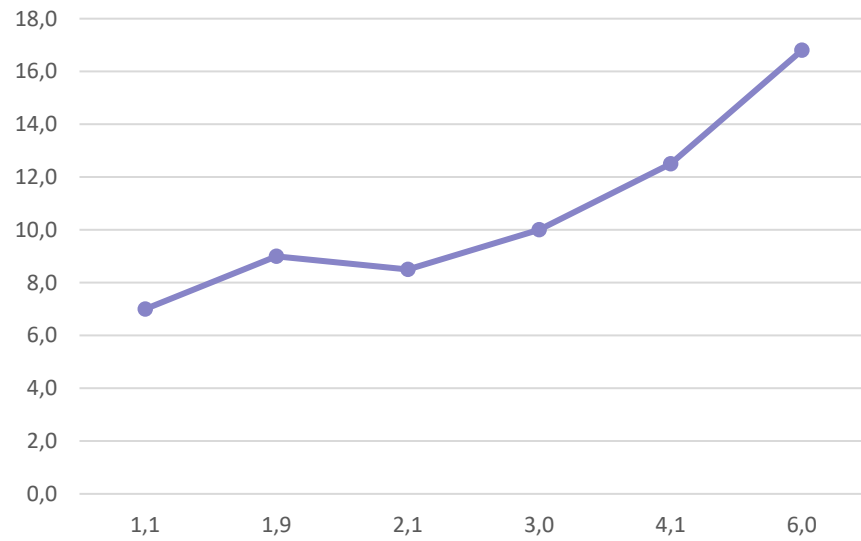


References

- IEEE citation style
- APA citation style



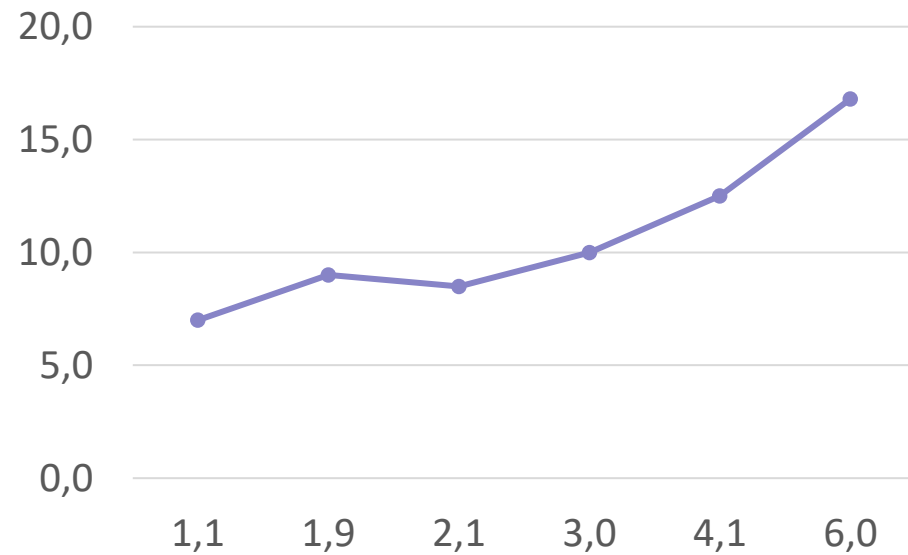
How to make a (better) plot



x	y
1.1	7.0
1.9	9.0
2.1	8.5
3.0	10.0
4.1	12.5
6.0	16.8



How to make a (better) plot

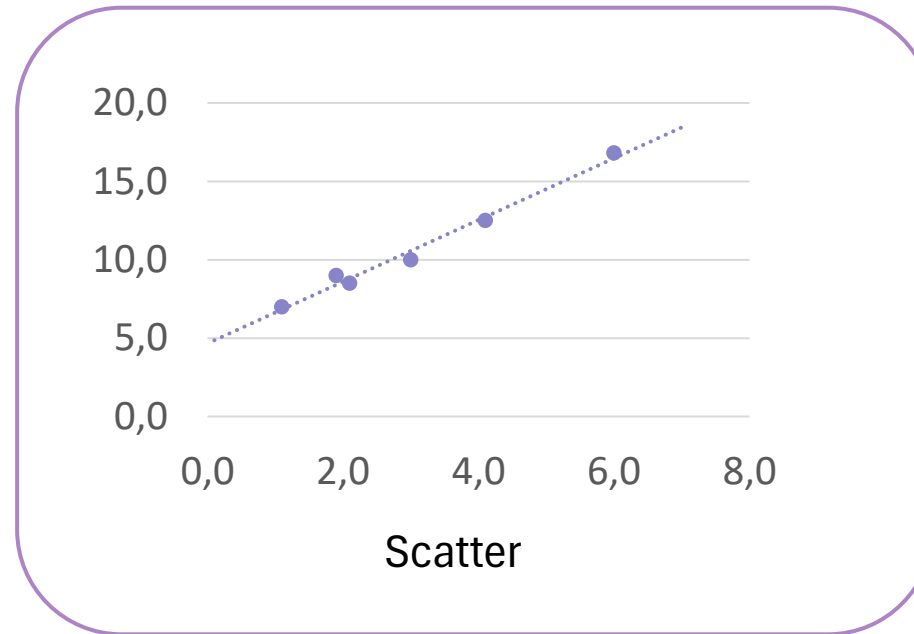
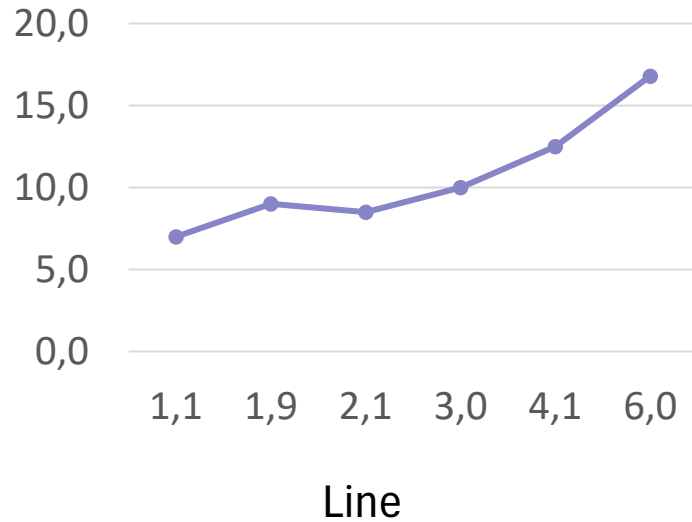


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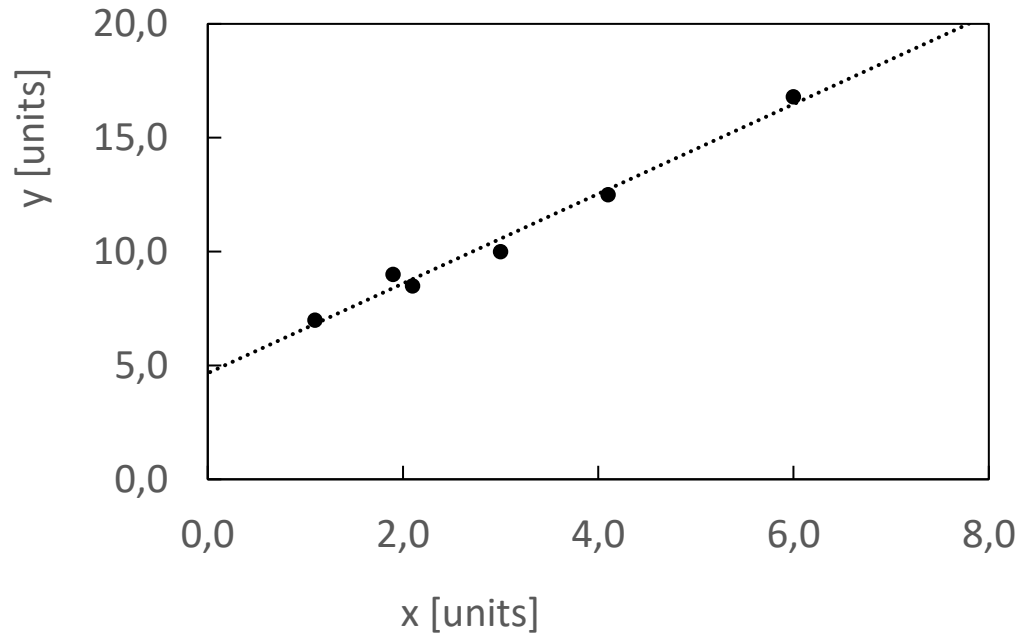
- Readable font size

How to make a (better) plot



- Readable font size
- Adequate chart type
- If useful, it can have linear trends for easy reading

How to make a (better) plot



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3.0	10.0
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- Readable font size
- Adequate chart type
- If useful, it can have linear trends for easy reading
- Axis with indication of quantities and units
- Use colour when it makes reading the plot easier
- Figures must have consistent formatting: same colours, same fonts, same appearance, etc.



Practice makes it easier...