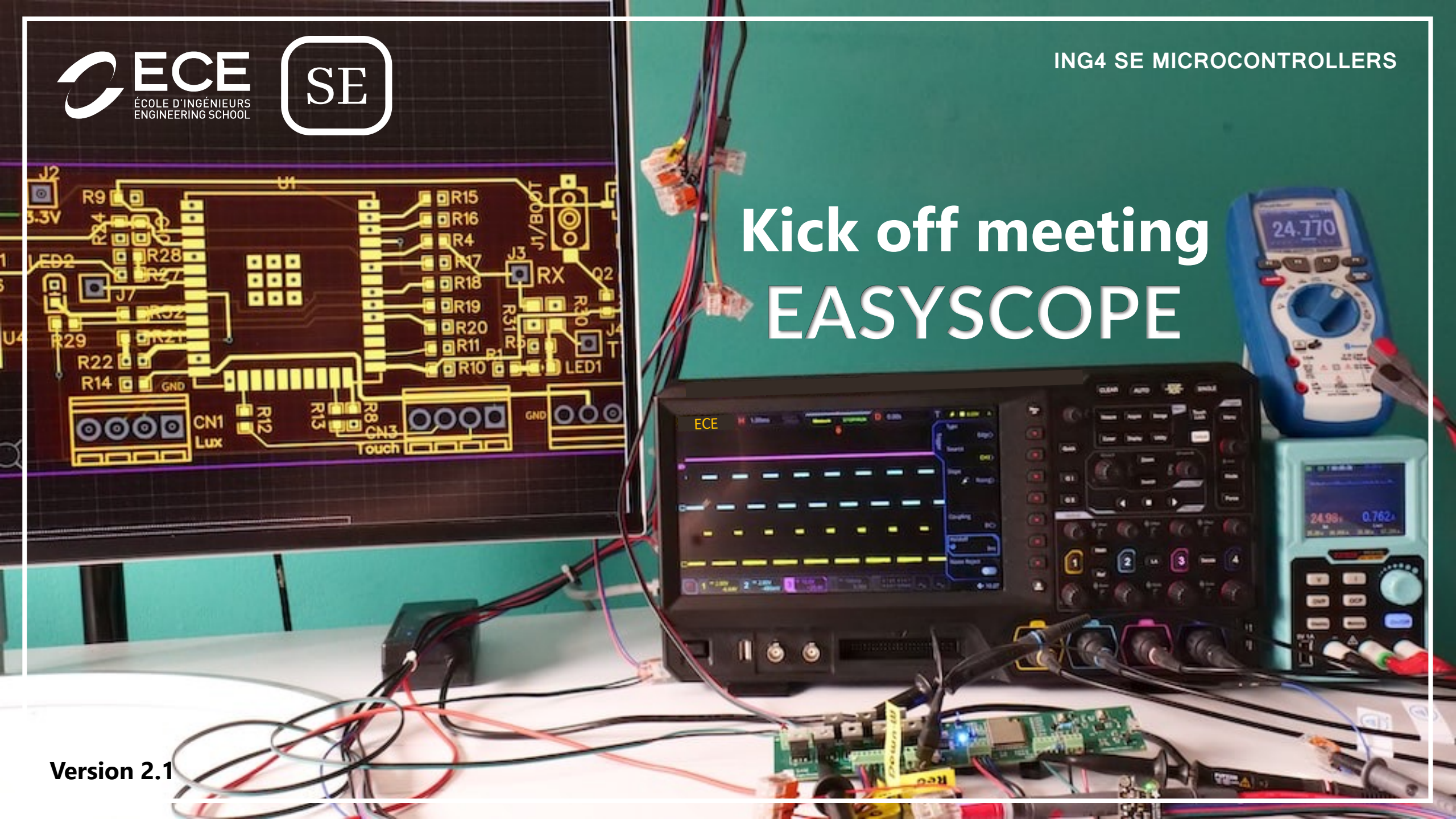
ECE
ÉCOLE D'INGÉNIEURS
ENGINEERING SCHOOL

SE

ING4 SE MICROCONTROLLERS

Kick off meeting
EASYSCOPE



Version 2.1

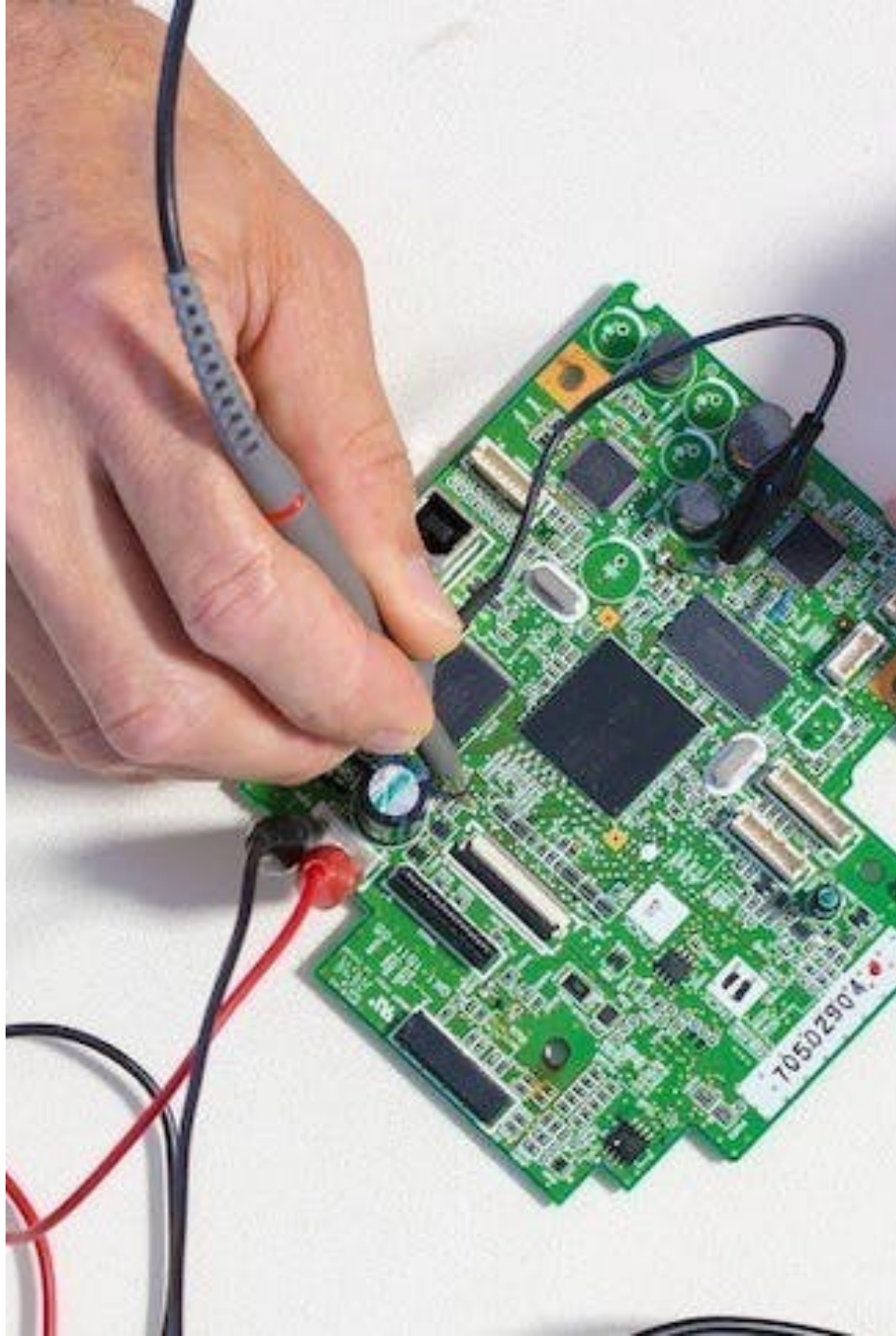
EASYSCOPE

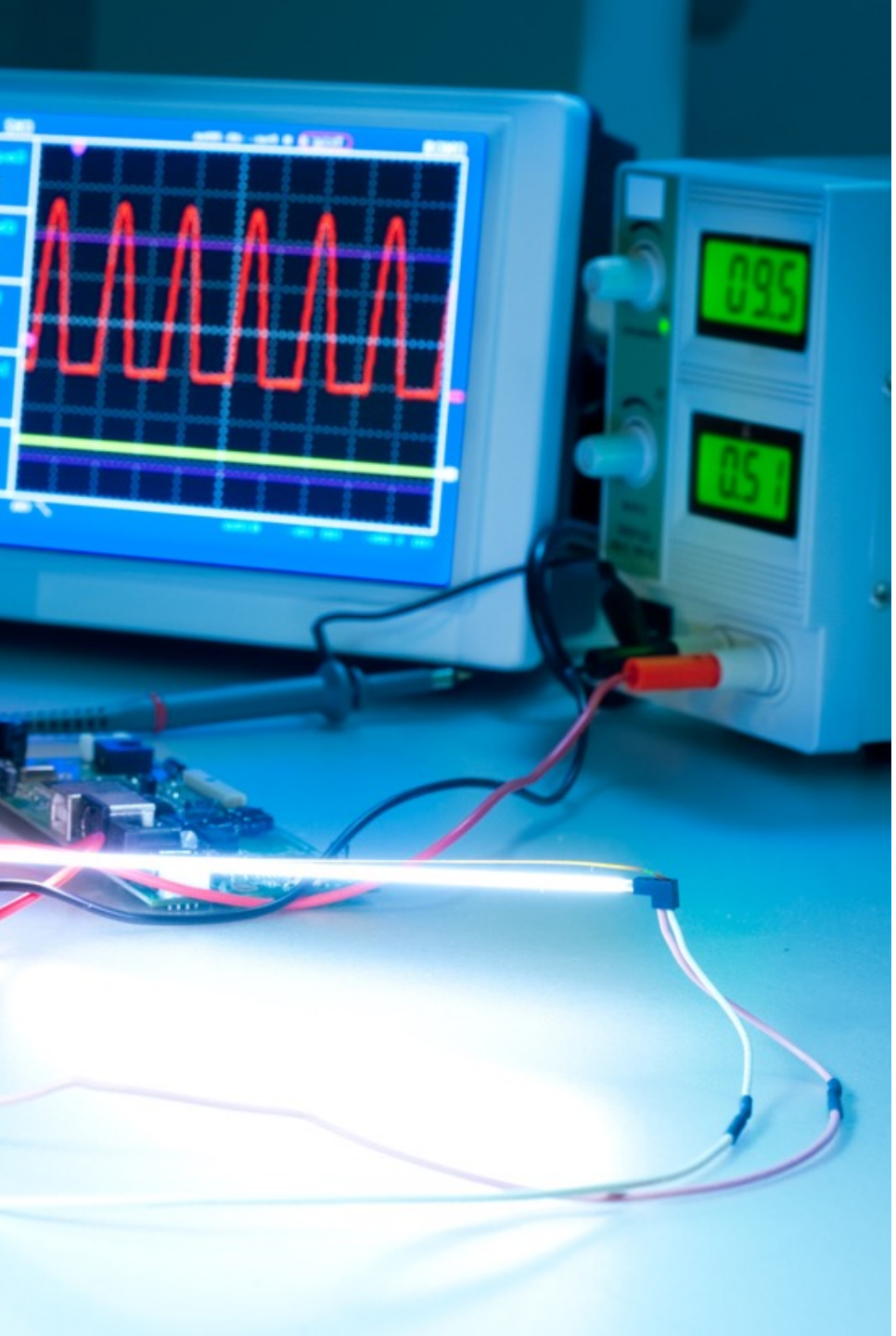
- groups composed of 2 teams of 2 students
- Material : 2 EasyPIC V.7 with GLCD screens, ECE electronics kit
- The project comprises two sub projects :

A function generator

An oscilloscope

- Oscilloscope probes can be asked to M. Ben Takhiat (SC 206 office).





Function generator

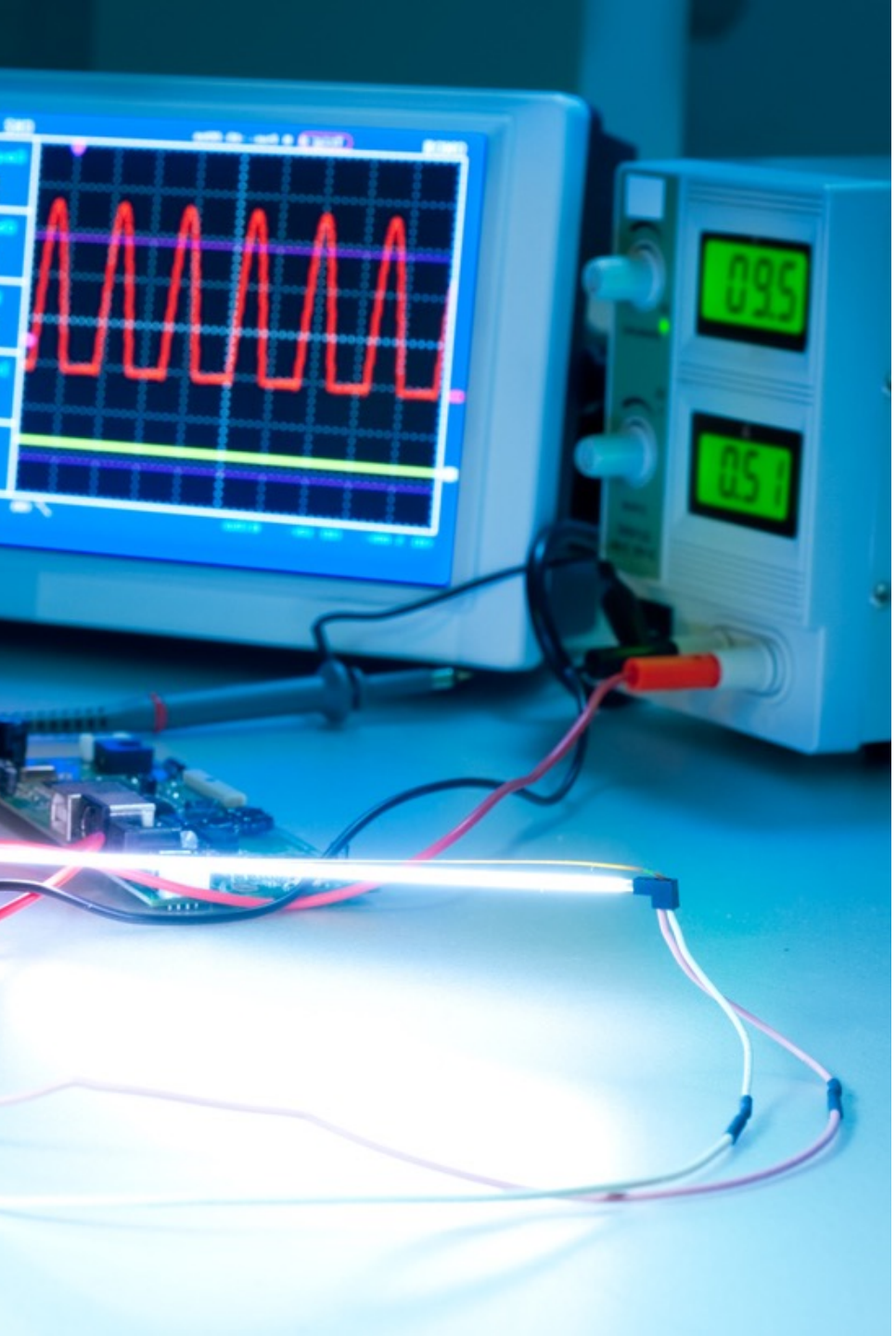
■ Your function generator has to be **coded in assembly** and to provide the four operating modes (chosen using push buttons, and displayed using LEDs) :

■ **Adjustable DC generator mode**

- In this mode, the PIC18F will command a home made 8-bit resolution R-2R DAC mounted on an external breadboard.
- The output voltage is adjustable using a potentiometer and displayed in mV on 7-SEG displays.
- Don’t forget to provide an Op Amp buffer at the output of your DAC.
- Make at least 10 measurements to get the output current as a function of the load, to provide a value of the maximum current your generator can drive.

■ **Rectangular wave generator mode**

- Frequency has to be adjustable (potentiometer) and displayed on 7-SEG displays, ranging from 10 Hz to 1 kHz linearly.
- Low voltage : 0 V, Pulsed voltage : 5 V.
- Duty cycle has to be adjustable using push buttons connected to a well chosen 8-bit port (1st button : $\alpha = 0.1$, 8th button : $\alpha = 0.9$) and displayed using LEDs on the same port : 1 LED per jumps of 0.1.
- Make different measurements using a (real) oscilloscope to validate this mode in low and ‘’high’’ frequencies, with different duty cycles.



Function generator

- **Sine wave generator mode**
  - In this mode, the generator will provide sine waves, with a constant amplitude of 1 V.
  - The R-2R will be used to provide an adjustable offset (potentiometer), that will be summed to the sinusoidal signal thanks to an Adder (Op amp).
  - The frequency has to be tuned using a potentiometer.
  - Frequencies will range from 10 Hz to 1 kHz linearly.

- **Triangle wave generator mode**
  - Using again the CCP module, the generator has to provide a sawtooth function, from 0 to 5 V.
  - You will ‘’only’’ need to implement the sawtooth function (not the symetric triangle function)
  - Frequency has to be adjustable using a potentiometer, and has to range from 10 Hz to 1 kHz linearly.
  - The frequency will be displayed on 7-SEG displays.

Oscilloscope

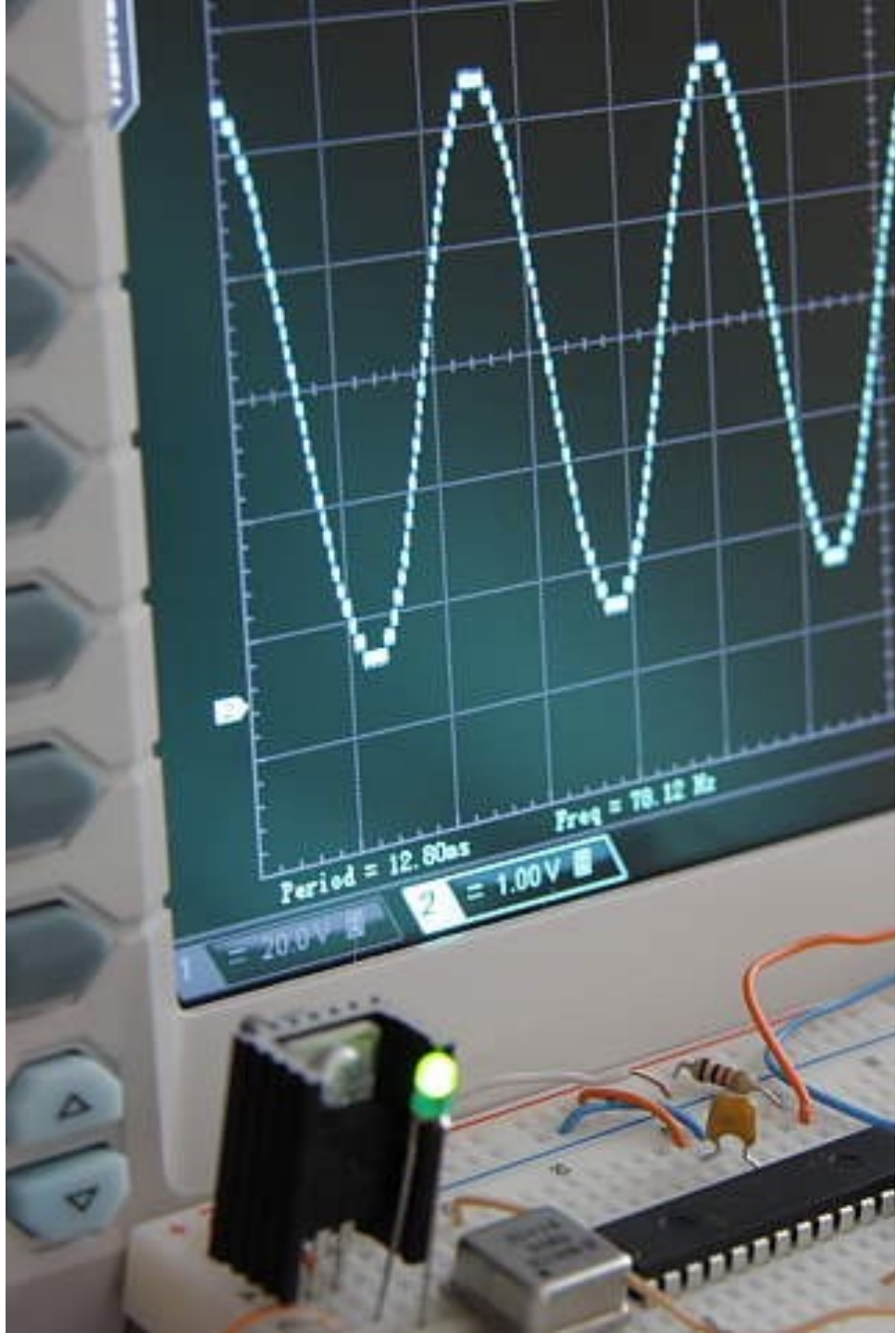
■ The other subgroup of 2 will work on an oscilloscope **developped in C (XC8 library)**, composed of two operating modes (chosen using push buttons, and displayed using LEDs) :

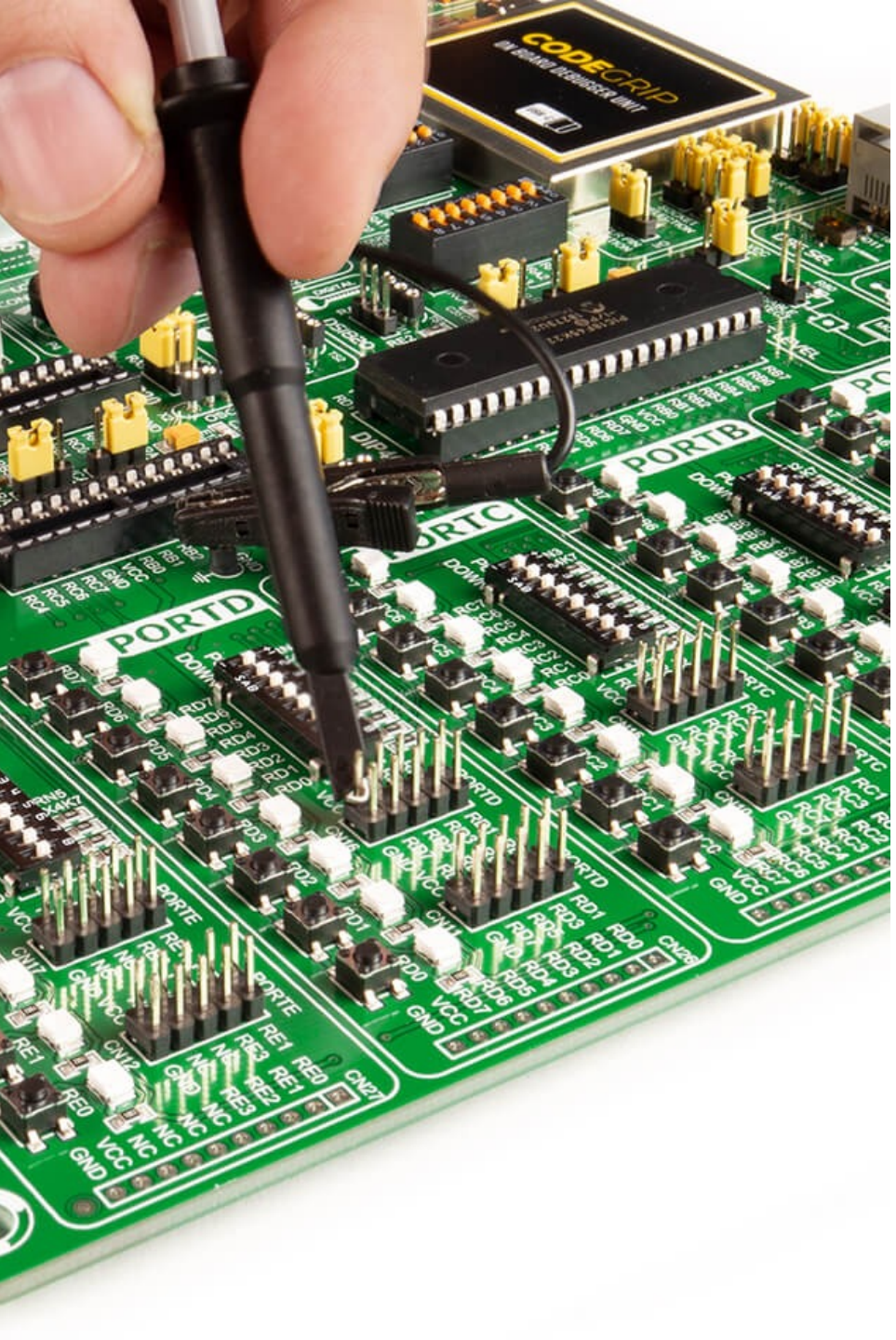
■ **Multimeter mode**

- This mode allows to measure a voltage in mV ranging from 0 to 5 V.
- Measured value has to be displayed in mV on 7-SEG displays
- The content of ADRESL and ADRESH as well as the sampling frequency have to be displayed on the LCD screen.

■ **Oscilloscope mode**

- The oscilloscope mode will use the GLCD screen and display the temporal evolution of a signal as a curve.
- When the screen is full (the curve reaching the right side of the screen), restart the signal display from the left (no need to blank the screen).
- 2 mode option using a single button interrupt to switch between them :
  - **RUNNING mode** : the signal is displayed continuously
  - **SINGLE mode** : the signal is only displayed (until reaching the end of the screen) once it has reached a given value.
- The time scale and the amplitude have to be adjustable using potentiometers. No constraints on the minimum and maximum values but a grid as well as a scale have to be shown on the screen.
- Verify your oscilloscope using a (real) function generator.





Project defense

8 min

❶ Oral presentation

- Present at least both functional diagram and schematic of your two subprojects (using KiCAD is mandatory)
- Present results and as many technical values you can (sampling frequency, resolution, maximum current, etc.)

4 min

❷ Demonstration

- Think in advance about a serie of tests to show that :

1. The generator is working properly
2. The oscilloscope is working properly
3. The two subsystems work can work together

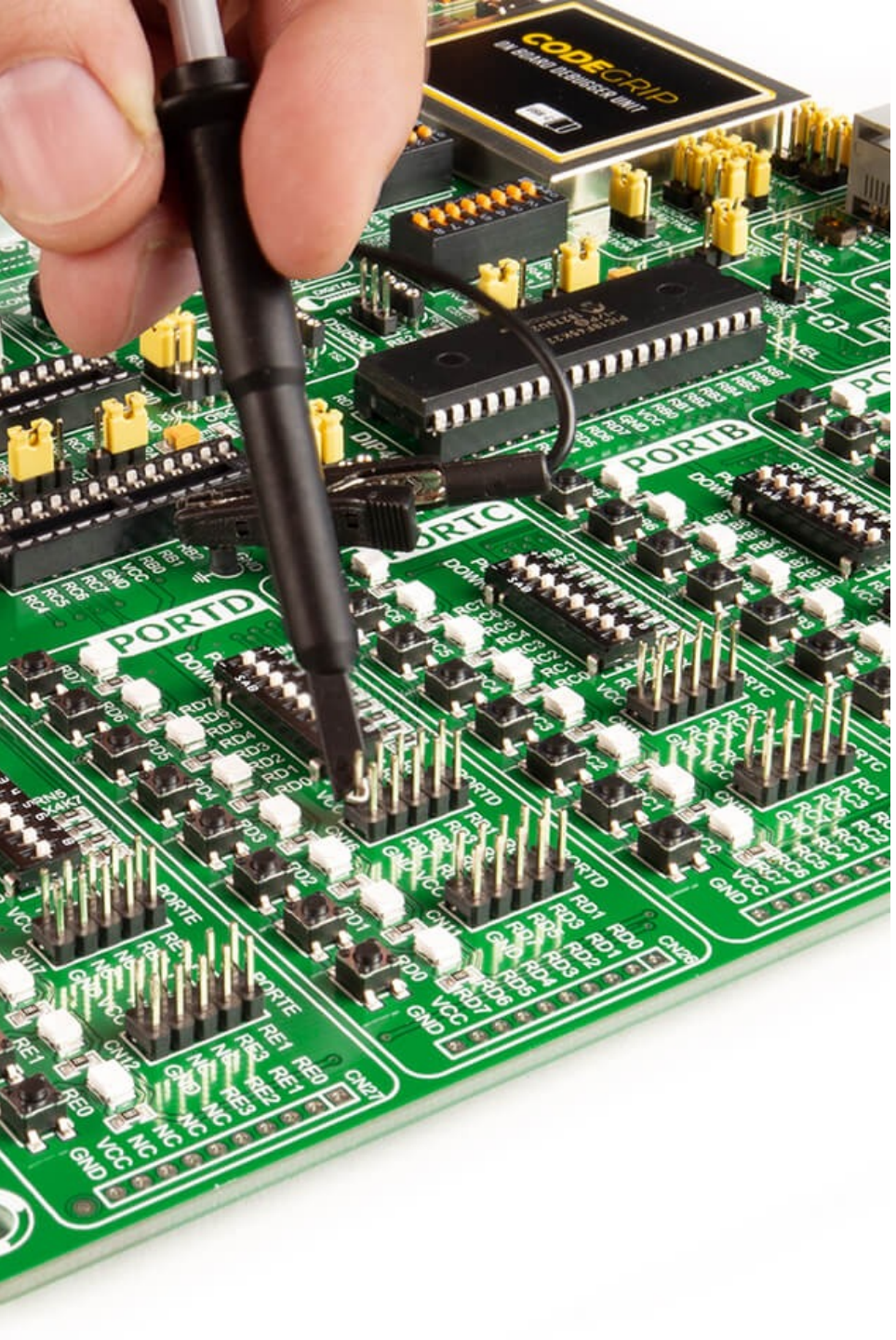
8 min

❸ Discussion

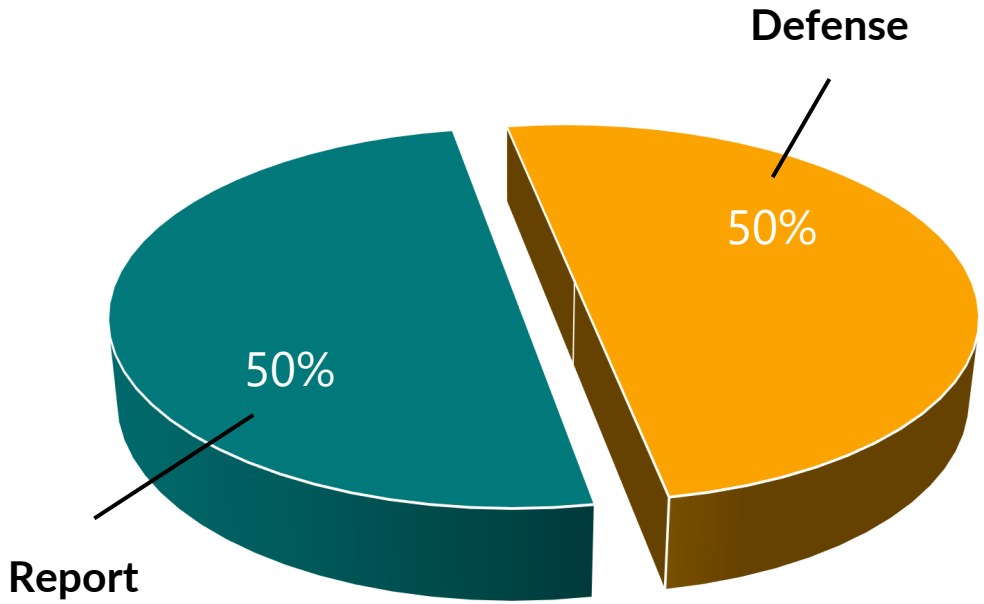
- Technical questions about your conception and tests.
- Think in advance about back up slides

- Test the projector
- Train yourself to make sure that your presentation will be 8 min long
- Bring a USB C – HDMI adaptor if necessary
- Be ready to be called at any time once the previous group enters the defense room

Make sure to master every technical details and to be able to present things clearly.
See « Comment préparer une soutenance » on LaToolbox for more advices.

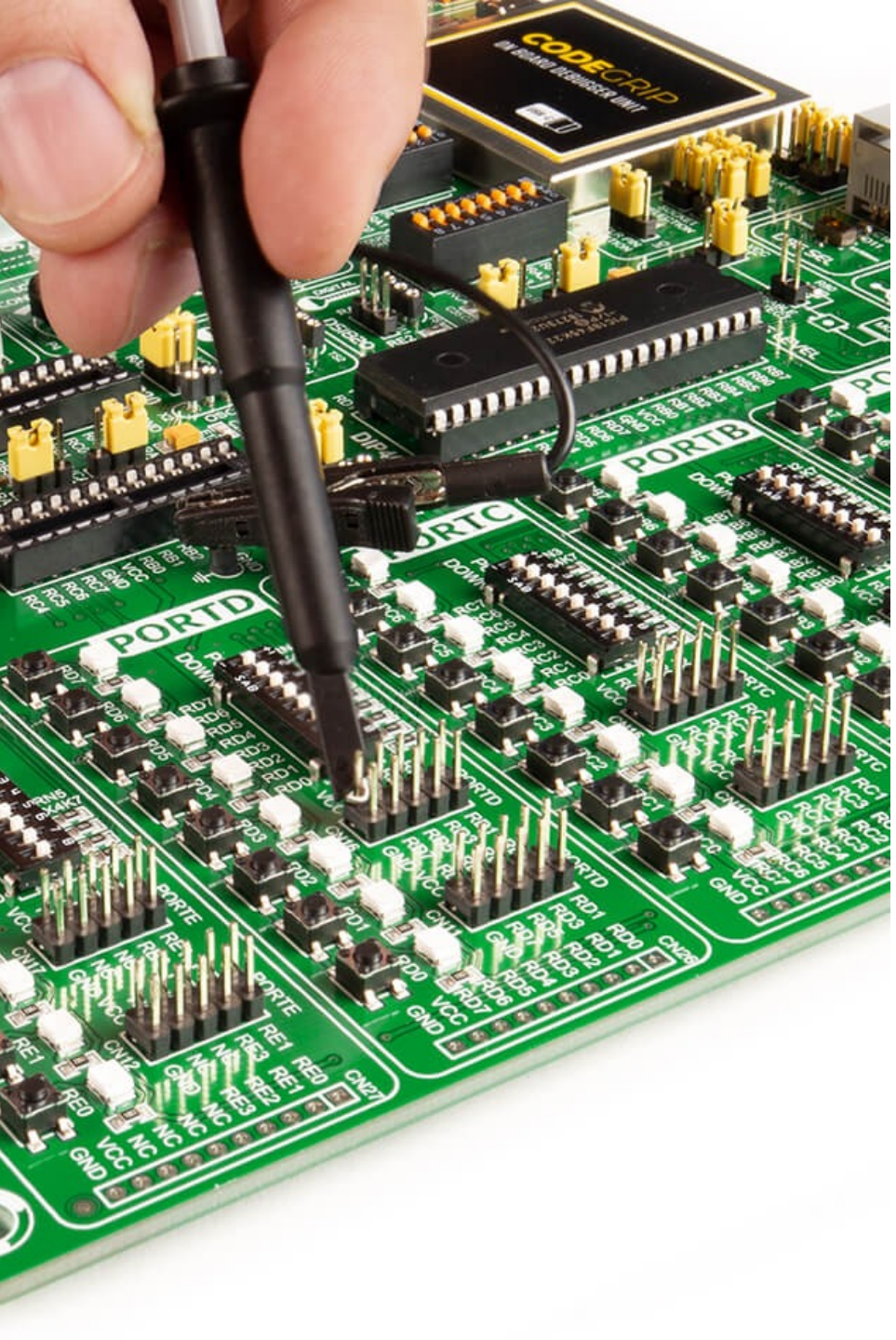


Grading



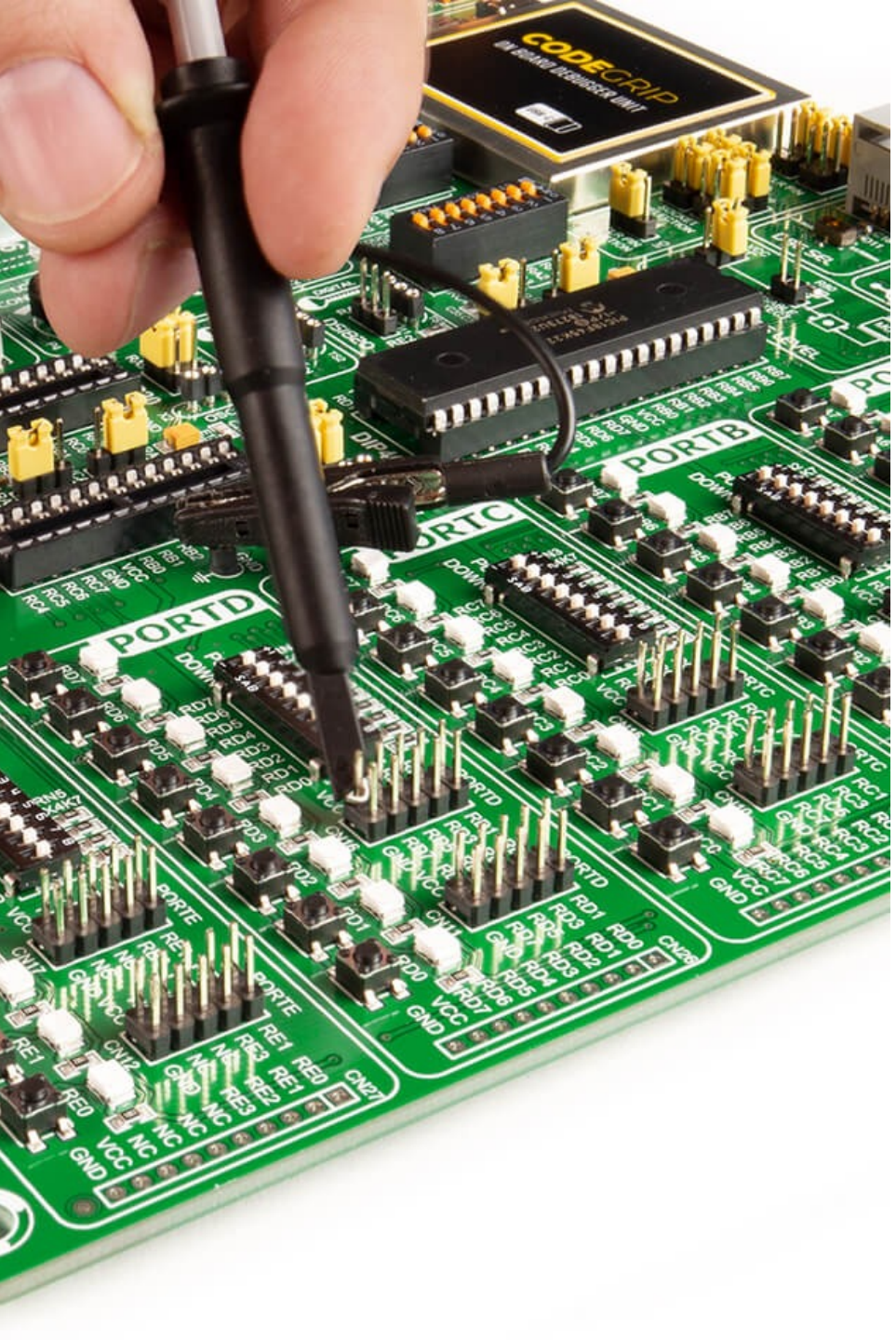
⚠ Using the La Toolbox template for the report is mandatory.
The report has to be exported in .PDF format.

🚀 **BONUS : a maximum of +1,5 points on the final grade for a Youtube video of your project.**



Defense

Item	Maximum mark	Description
Technical level of the presentation	2	Quality of the technical explanations The content of the presentation is clear and truthful
Form	2	Overall quality of the powerpoint Quality of the diagrams, figures, etc.
Function generator subsystem	1	Functional diagram **+0,5 mark** Schematic **+0,5 mark**
Oscilloscope subsystem	1	Functional diagram **+0,5 mark** Schematic **+0,5 mark**
DC generator 0/7 if the function generator is developped in C.	1,5	DAC R-2R, 8-bit resolution, adjustable output voltage (potentiometer), displayed in mV on 7-SEG displays Output current as a function of the load curve
Rectangular wave generator	2	Adjustable frequency from 10 to 1k Hz (potentiometer), adjustable duty cycle (push buttons), constant amplitude of 5 V.
Sine wave generator	2	Constant amplitude of 1 V, adjustable offset (potentiometer), adjustable frequency from 10 to 1k Hz
Triangle generator	1,5	Sawtooth function, adjustable frequency (potentiometer), frequency displayed on 7-SEG displays
Multimeter mode	2	Voltage from 0 to 5 V, in mV, displayed on 7-SEG displays, content of ADRESH and ADRESL and sampling frequency displayed on the LCD.
Oscilloscope mode	5	Curve on GLCD, running mode, trigger mode, adjustable time and amplitude (potentiometers), grid and clear scale



Report

Item	Maximum mark	Description
Form	3	Clear figures with captions with reference to them in the text Orthograph Quality of figures Clear axis on graphs No code but (commented) algorigrams
Objective, context, problematic, sources, annexes	-1 to 0	*See the template on La Toolbox page*
Presentation of the team, GANTT diagram	1	Clear diagram Clear presentaiton of the repartition of the workload Good time management
Conception	3	Functional diagrams, schematics (KiCAD) and algorigrams Presentation of the design approach
Developpement	6	Quality of technical explanations General outcome of the project Precise presentation of how each modules are made Proteus simulations for the main features
Tests & validation	5	Unit tests and validation
Summary	2	Summary about what has been done and learnt Technical relevance of the solution
LaTeX	1	Up to 1 mark for reports made in LaTex
Template	-2	Using the template is mandatory
PDF	-2	Report has to be exported in .PDF format


Good luck !