Tuesday, 4 April 2023

Calibration campaign of sensors for the instrumented baffle

A calibration coefficient C can be defined for each filter, temperature, humidity and angle of incidence: C = C (filter, T, humidity, angle). The goal is that, for a fixed values of filter, T, humidity, angle, we have a certain calibration coefficient C of the setup 1, that is used in setup2 to know the real power measured by the PD. The setup 1 will give us a linear relationship between the injected power measured by the Keithley (V) and what is measured by the PD (W), as $P_{measured} = C*V$.

Once the value of C is obtained for each point of the parameter space, the systematics are those associated to these quantities added in quadrature, which define the systematic error budget of the calibration coefficient.

The proposed parameter space to explore is the following:

- Filters: (note that the effect of filters is not linear=> different laser power is transmitted)
- Temperature: [19, 25]
- Humidity: explore the typical humidity conditions, although the optics lab is dry.
- Angle of Incidence: [0, 10] Note that 0 is specially interesting case because light is reflected, although when the sensors will be mounted, this will be only achieved with scattered light

To understand the origin of the uncertainties, on the calibration coefficient measurement which actually come from the setup itself, one can look into dark noise measurements of the PD alone:

- Laser OFF: Dark noise measurements
  - Stability of the signal during nights (stress tests with time)
  - Stability of the measured signal with temperature.

These errors are the minimum uncertainties that are due to the setup design itself. Then, to obtain the full uncertainty budget, one needs to go through the parameter space. First, for each filter after the laser:

- Laser ON: Calibration coefficient measurement (set-up 1)
  - Stability of the signal during nights (stress tests with time)
  - Stability of the measured signal with temperature and humidity. Precision level of these temperature changes
  - Systematics associated with geometrical parameters, angle of incidence (X-Y table?)

Note (?): if the systematic errors are obtain thanks to the setup1, one can not directly use these as the reference of setup 2. One needs to remove the dark noise from the Powermeter and then add that of the dark noise measurements of the PD.

Questions:

- The sensors will be in vacuum
- Diffuse light, not a laser. So these would be ‘worst case scenario’ (although the sensors may be used for alignment of beam?)
- If there are order 220 sensors, should we do these tests for ALL of them? (This refined analysis is not actually done in PCal actually..)
- If green light is used for alignment, the PD need to be calibrated as well in that wavelength.