# Collimated Beam Projector status

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# Why a CBP ? What is a CBP ? How ?

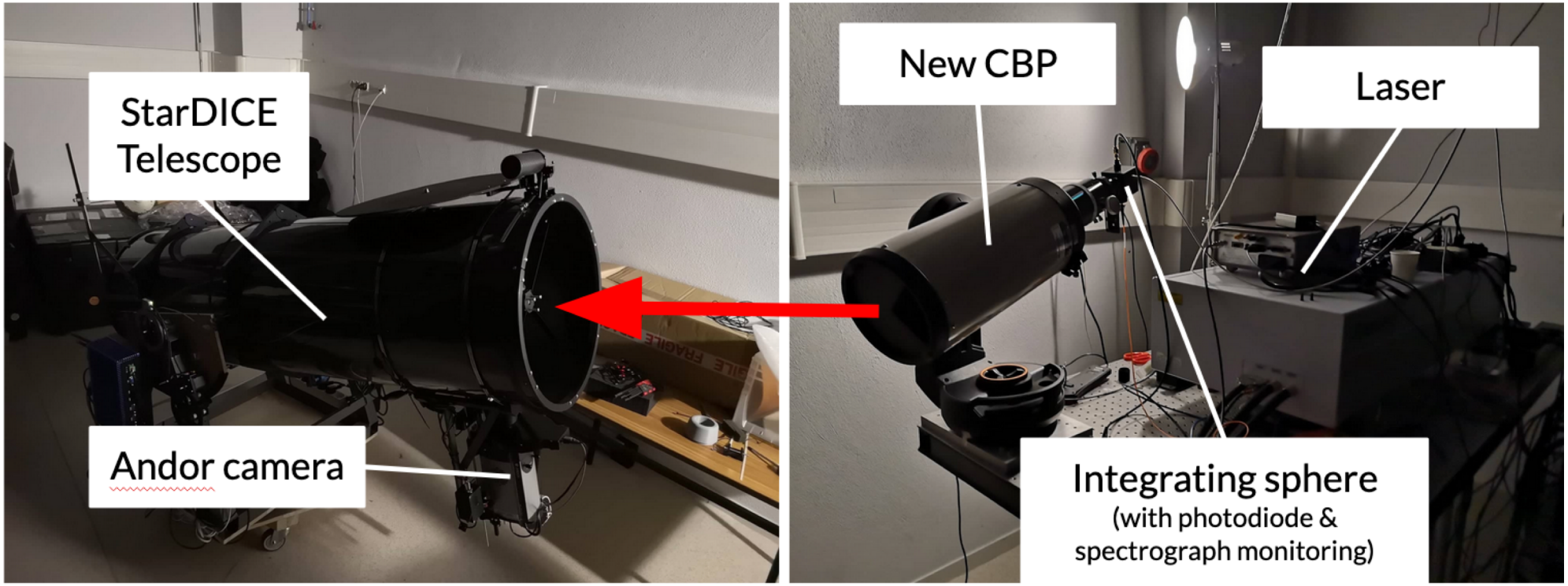
- Why ? To measure a telescope transmission at <1% across visible spectrum (StarDice, VRO, AuxTel, ZTF, etc.)

- What ? CBP, a Collimated Beam Projector, which is able to shoot a known quantity of photons at a known wavelength in a parallel beam (to mimic a monochromatic star of known flux)

- How ? Collaboration with Harvard (Christopher Stubbs and LPNHE)

# How do you build a CBP ?

General recipe : put a powerful point source of known flux and wavelength at the focus of a telescope



# CBP evolution : April 2021

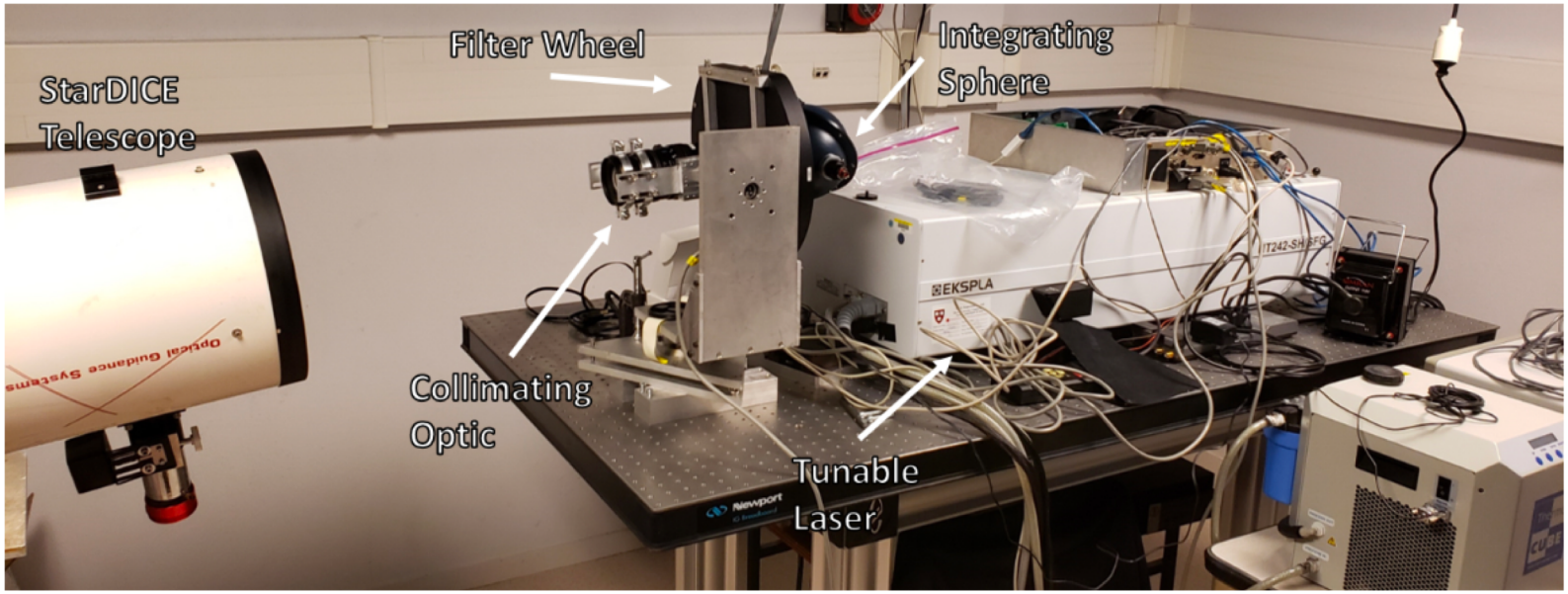
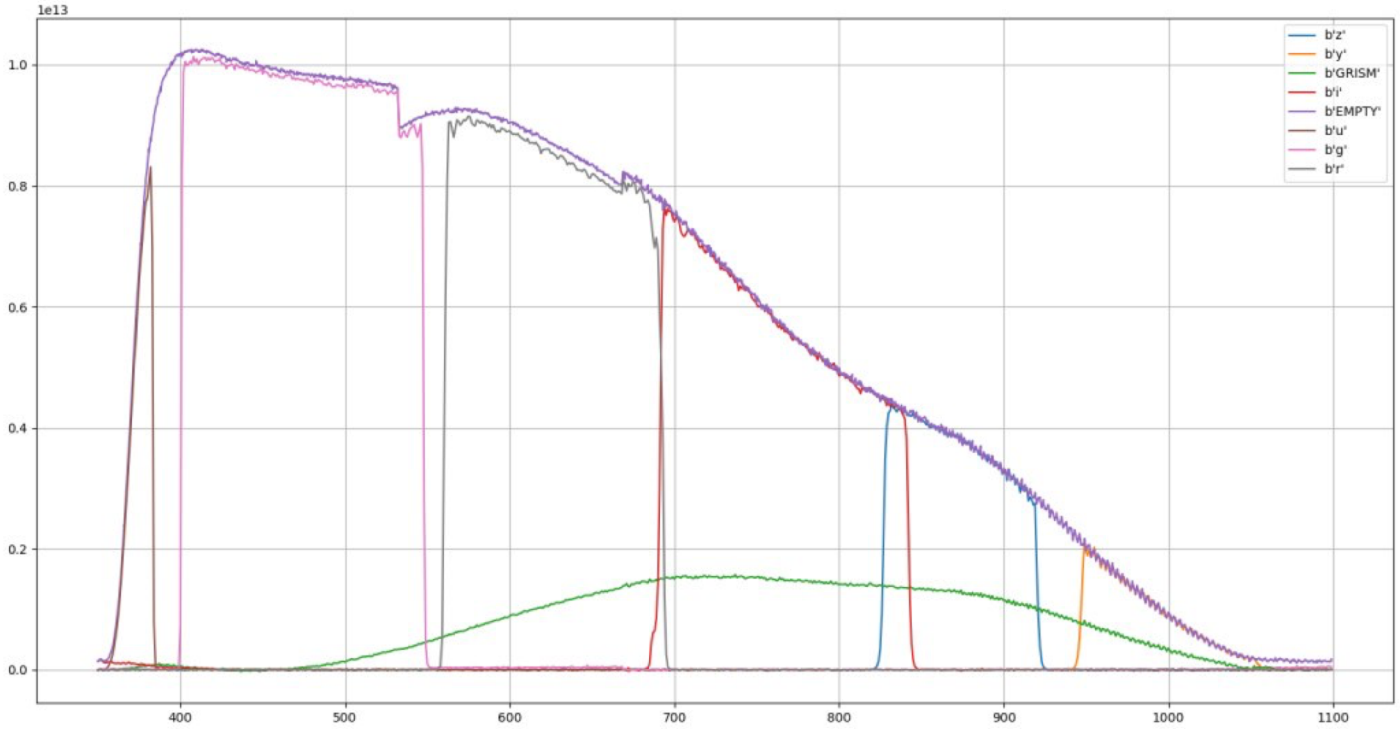



**Fig 1** An image of the CBP installed in the StarDICE lab at LPNHE. The arrangement roughly mimics that expected during StarDICE operation at the Observatoire de Haute Provence.

First CBP/DESC paper in the publication process !

# Preliminary CBP and StarDice transmissions

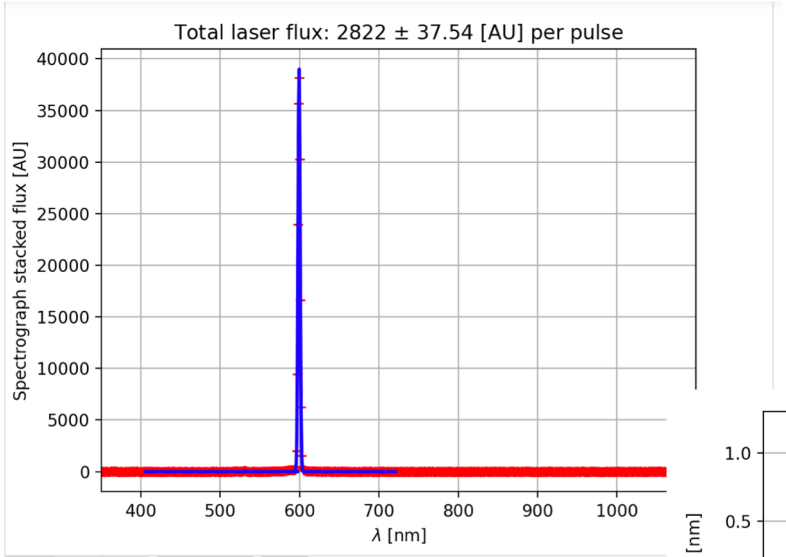



Caption : StarDice telescope transmission measured with the April 2021 version of the CBP.

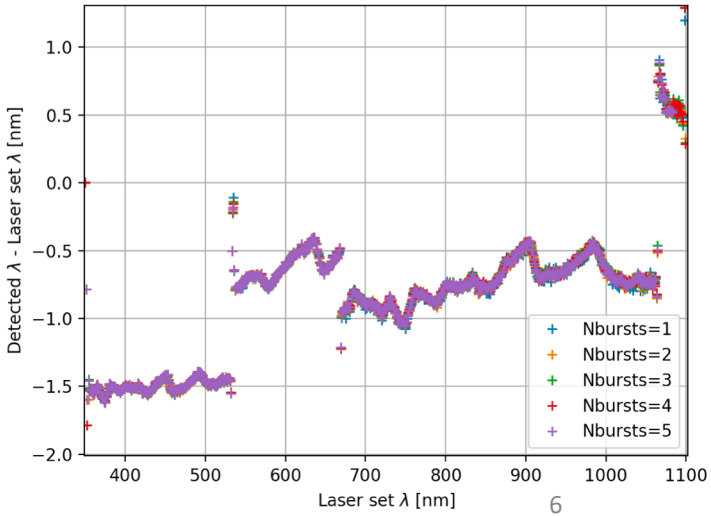
# How do you monitor the photons ?

Wavelength : with a fiber collecting the light in the integrating sphere and shooting it into a calibrated spectrograph

=> recalibration of the laser wavelength <1nm



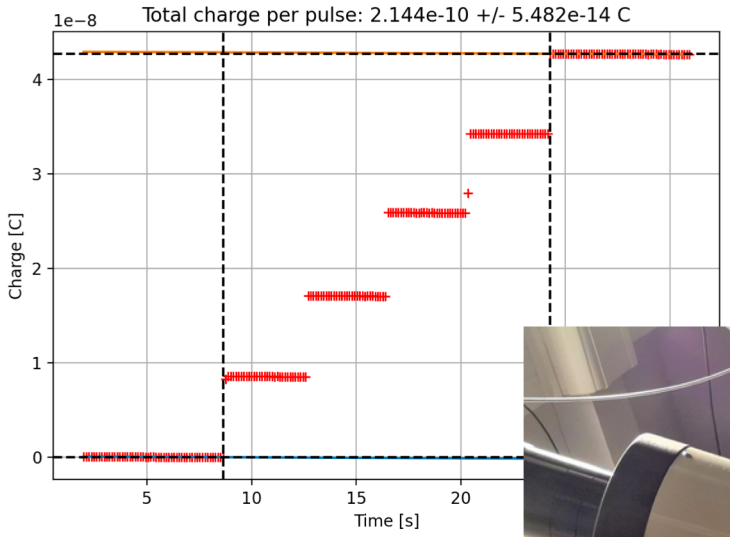

| Line | Tabulated nm | Detected nm | Shift nm | FWHM nm | Amplitude |
|---|---|---|---|---|---|
| LL532 | 532.0 | 530.9835 | -1.0164753 | 2.6846395 | 100.29906 |
| L600 | 600.0 | 599.41156 | -0.58844966 | 3.0481155 | 39382.18 |
| L600^(2) | 1200.0 | 1195.1426 | -4.857392 | 1.8666929 | 6.098692 |

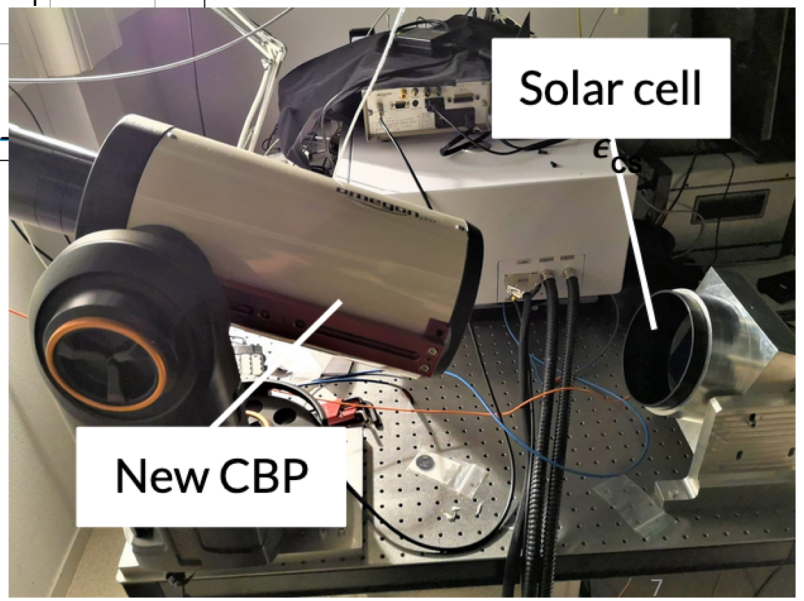


# How do you monitor the photons ?

Flux :

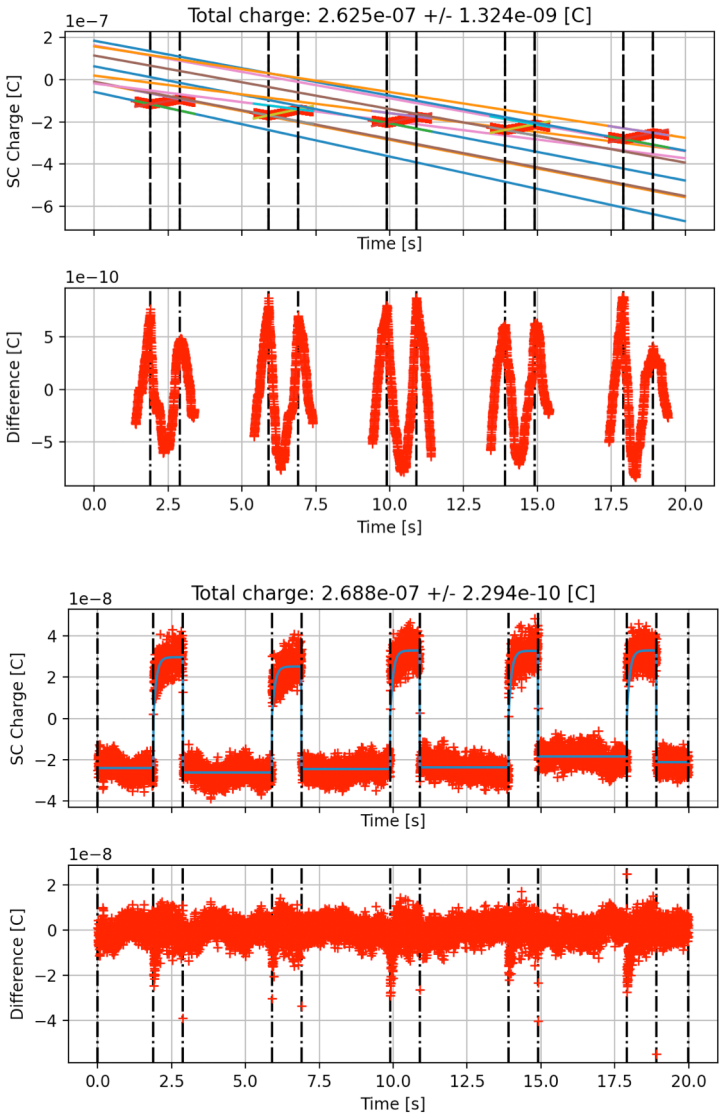
- with a photodiode on the integrating sphere and plugged to a charge-meter (better than permil)
- **with a large NIST-calibrated solar cell to get optics transmission => our main tsk since July 2021 !**



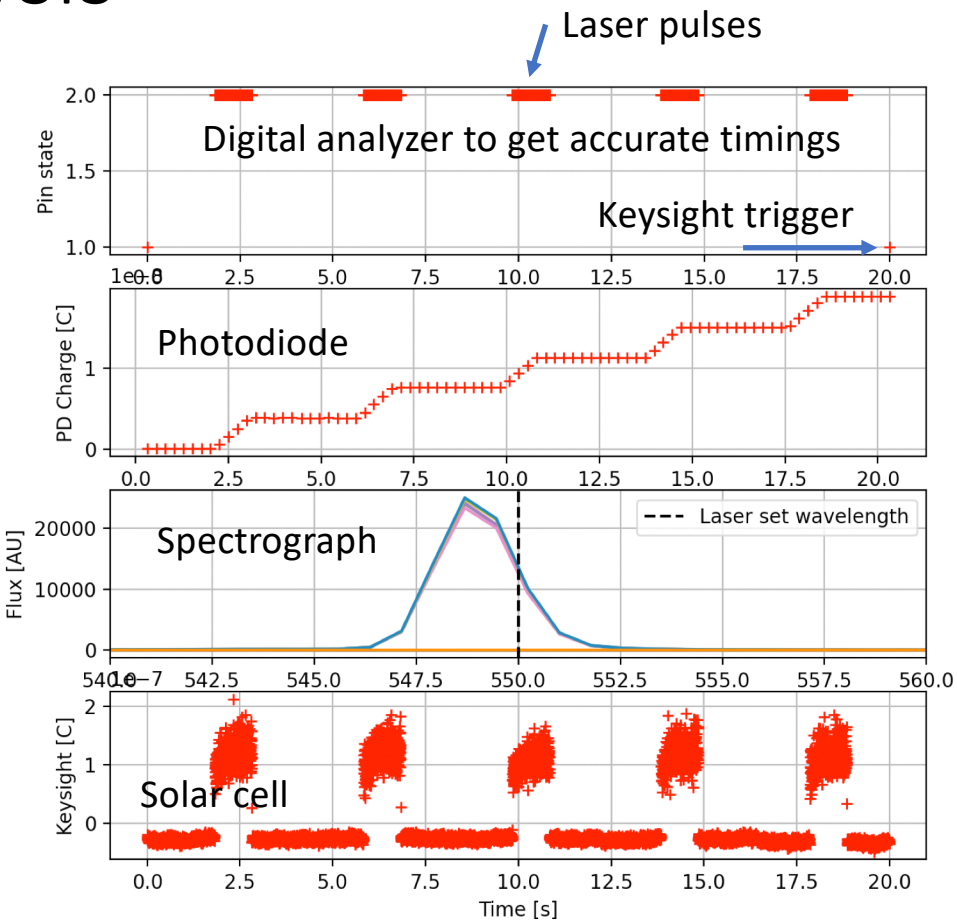
# Status of the solar cell analysis

- Solar cell accumulated charges are read by a Keysight electrometer at 500Hz => fit a piecewise linear function per burst with known time breaks (since yesterday !)
- Two issues :
  - 1. waveform not understood
  - 2. dark current correlated fluctuations
- Use the Keysight in amperemeter
- Ongoing work : comparison of the two methods and estimate of systematics



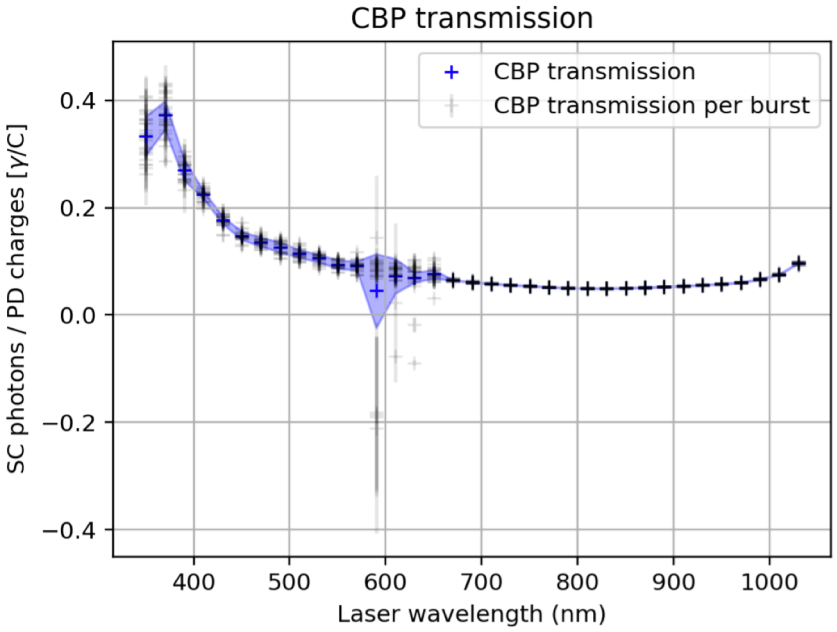
# Status of the solar cell analysis

- Full acquisition system is ready
- Full analysis pipeline is ready
- Needs to check systematics :
  - Linearity of the instruments with power
  - Chromaticity effects due to pinhole diameters
  - Chromaticity effects with solar cell inclination
  - etc

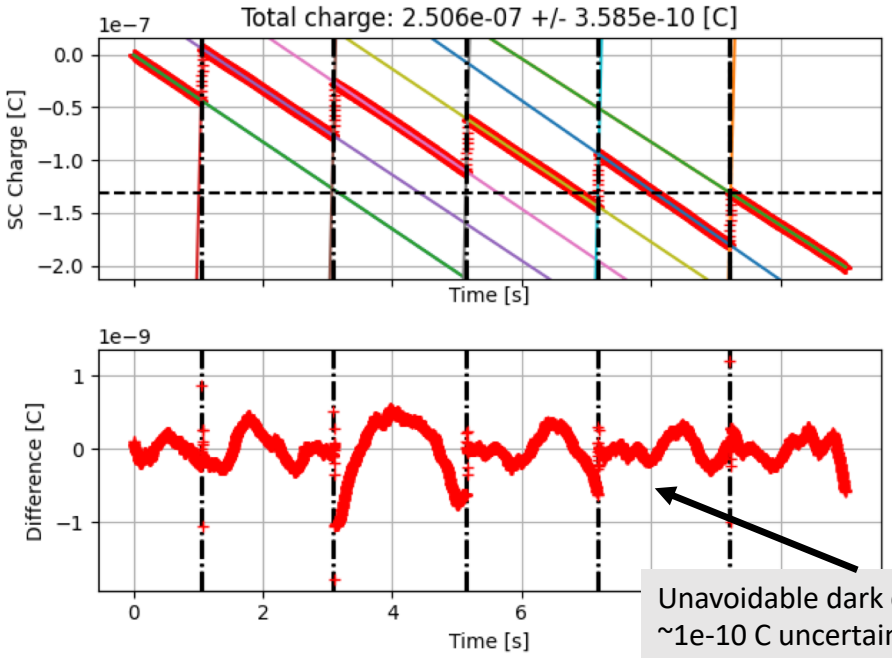


# Status of the solar cell analysis

Switch to a « per burst » analysis having fine burst timings and finer algorithms




Model of the dark current with Gaussian Process (see [P-F. Léget DESC School tutorial])



# Planning

- December 2021 :
  - **Redo and redo everything fighting the dark current !**
  - Evaluate the systematics (in particular for the solar cell calibration)
- January (February ?) 2022 :
  - Measure the StarDice telescope
  - Write a DESC paper !
- Spring 2022 :
  - Characterize a portable CBP, the CBP-Lite which is in development at Harvard (with a more practical light source and with Kélian !)
- Summer 2022 :
  - Remeasure the StarDice telescope to qualify the CBP-Lite
- Autumn 2022 :
  - Measure other telescopes : ZTF-II, AuxTel, etc.