Online Optical Probes for Quality Control and Safety Assessment of Olive and Other Edible Oils

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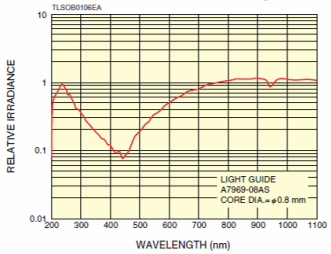
Demokritos, November 2013

Ευρωπαϊκή Ένωση
Ευρωπαϊκό Κοινωνικό Ταμείο
ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ
ΕΚΠΑΙΔΕΥΣΗ ΚΑΙ ΔΙΑ ΒΙΟΥ ΜΑΘΗΣΗ
επένδυση στην κοινωνία της γνώσης
ΥΠΟΥΡΓΕΙΟ ΠΑΙΔΕΙΑΣ & ΘΡΗΣΚΕΥΜΑΤΩΝ, ΠΟΛΙΤΙΣΜΟΥ & ΑΘΛΗΤΙΣΜΟΥ
ΕΙΔΙΚΗ ΥΠΗΡΕΣΙΑ ΔΙΑΧΕΙΡΙΣΗΣ
ΕΣΠΑ 2007-2013
ΕΥΡΩΠΑΪΚΟ ΚΟΙΝΩΝΙΚΟ ΤΑΜΕΙΟ
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

* Light guide is sold separately.

SPECTRAL DISTRIBUTION
(TYPICAL DATA)



Light Source

•Optical fibres

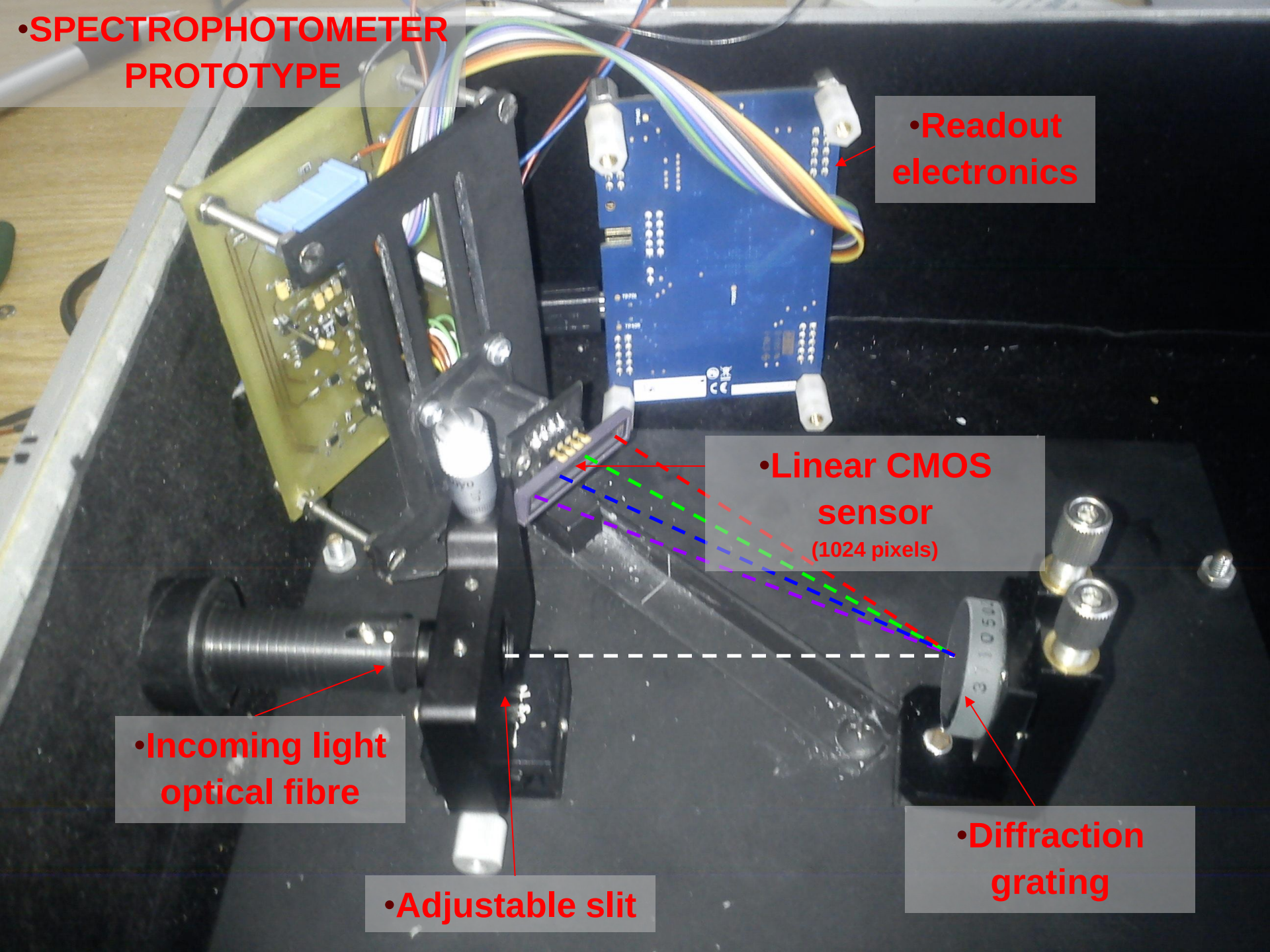
Sample

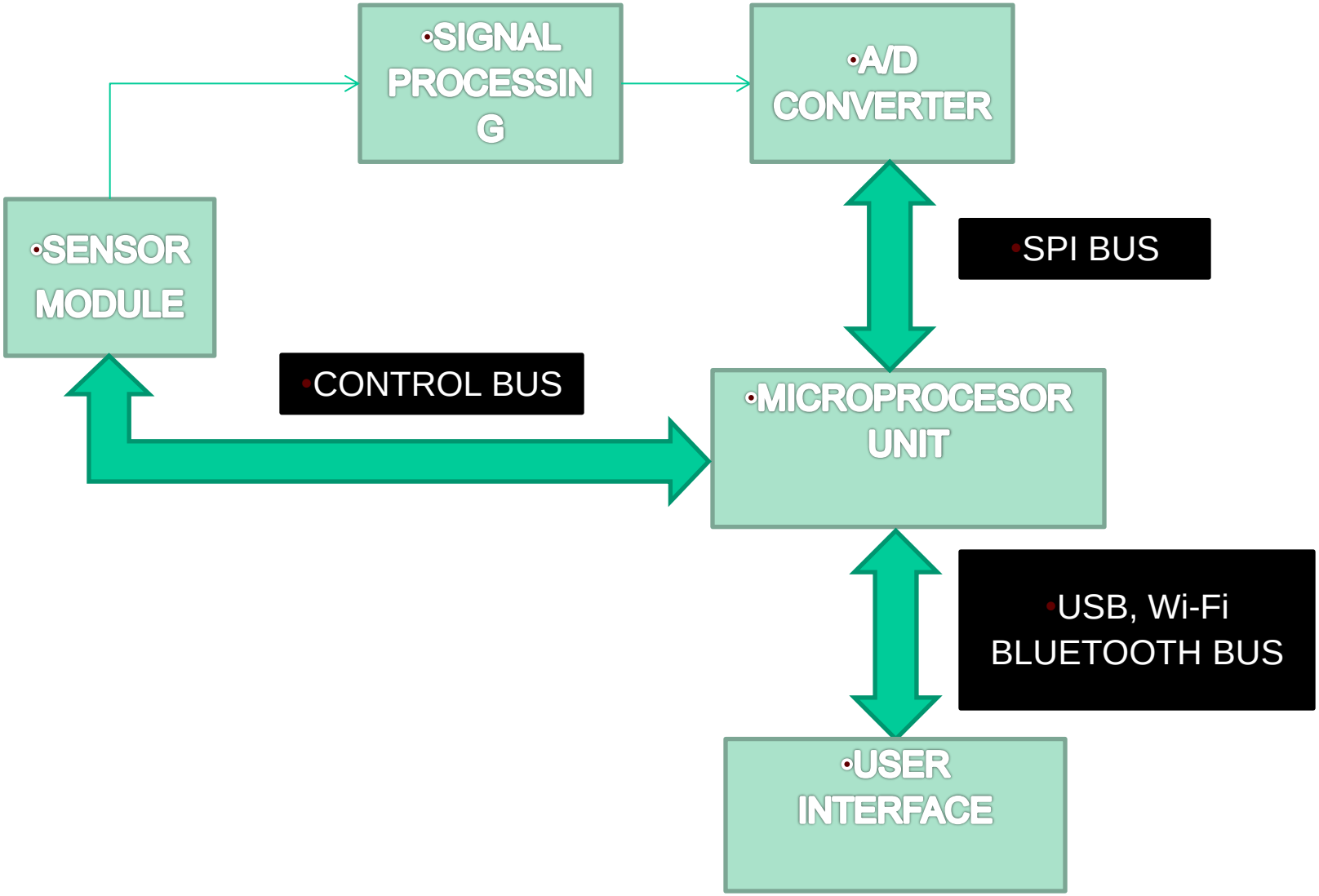
Light Sensor

Collimating Optics

Grating

Spectrophotometer


•SPECTROPHOTOMETER PROTOTYPE
•Readout electronics
•Linear CMOS sensor
(1024 pixels)
•Incoming light optical fibre
•Adjustable slit
•Diffraction grating

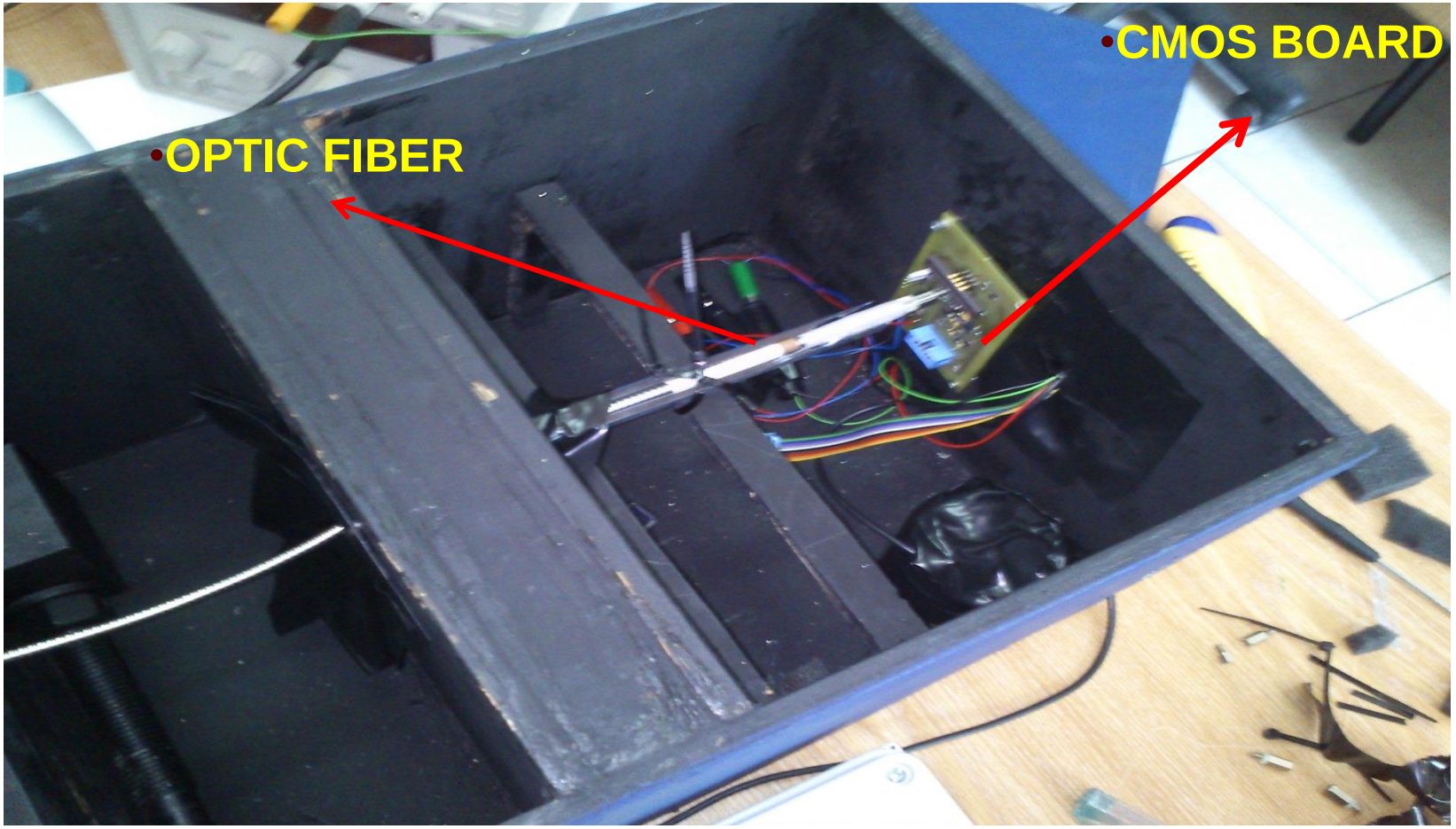

•SIGNAL PROCESSIN G
•A/D CONVERTER
•SENSOR MODULE
•SPI BUS
•CONTROL BUS
•MICROPROCESOR UNIT
•USB, Wi-Fi BLUETOOTH BUS
•USER INTERFACE

IN HOUSE CMOS MODULE

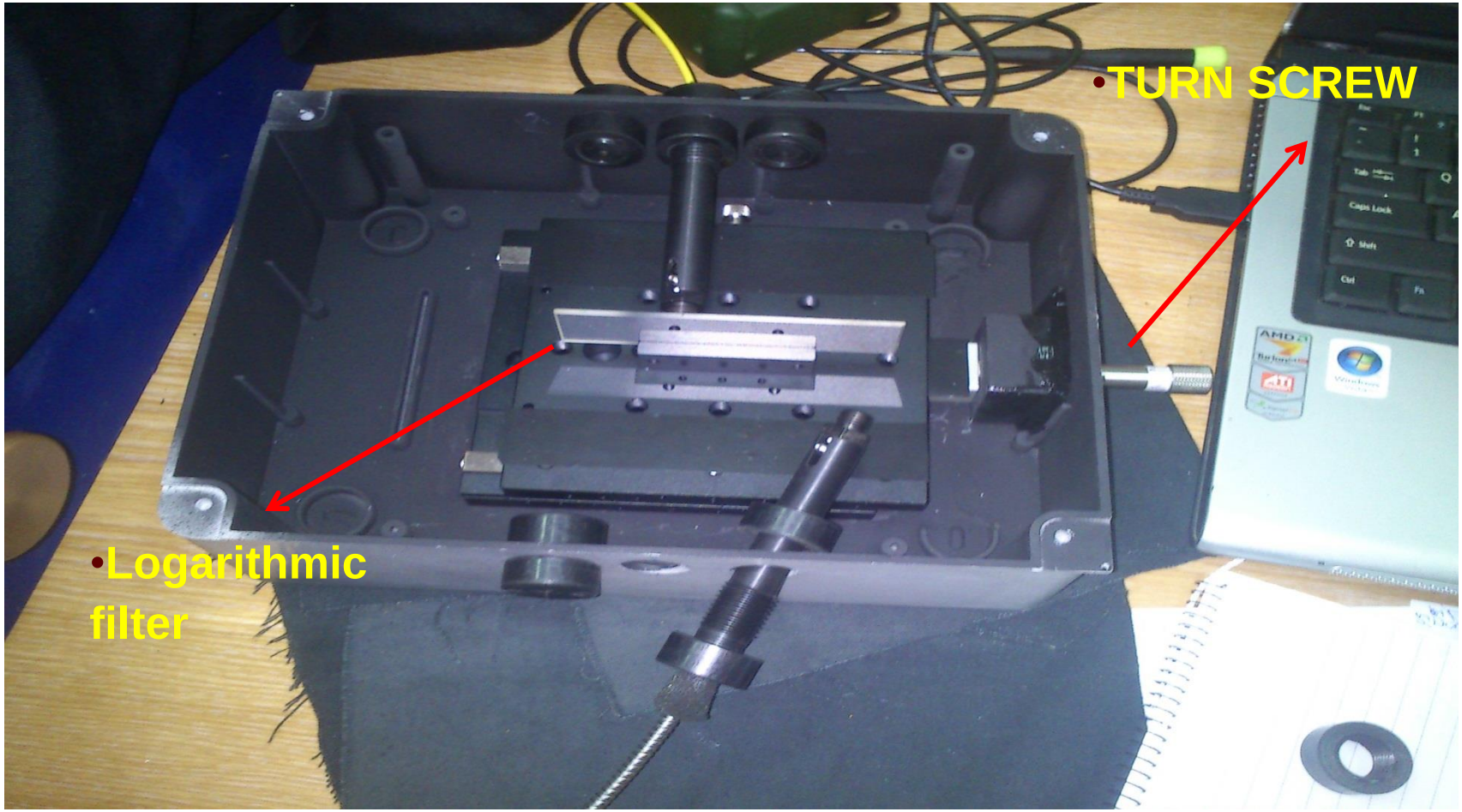
- After designing the CMOS board a set of tests took place for the linearity and dark RMS noise of the sensor-board module.
- We used a modified wooden box to place the module and another case for the logarithmic filter and the single axis translation stage.

  Modified cases where developed by G.Kiskiras and D.Vakondios
- Measurements where analyzed with a Linux software developed by D.Lenis

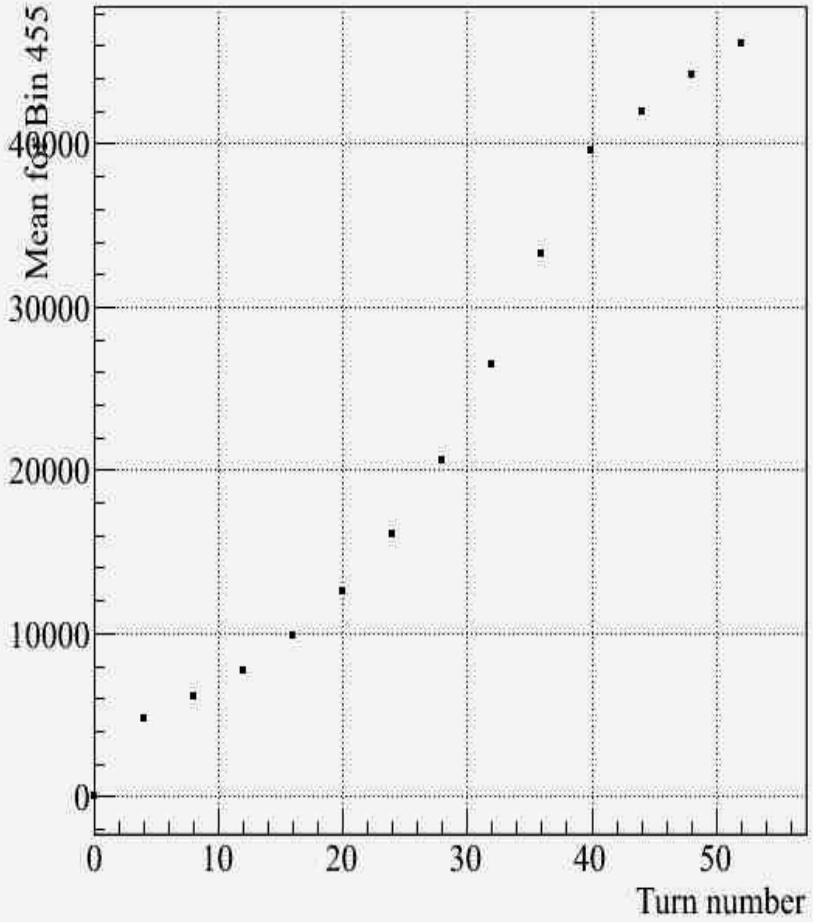
TEST CONDITIONS



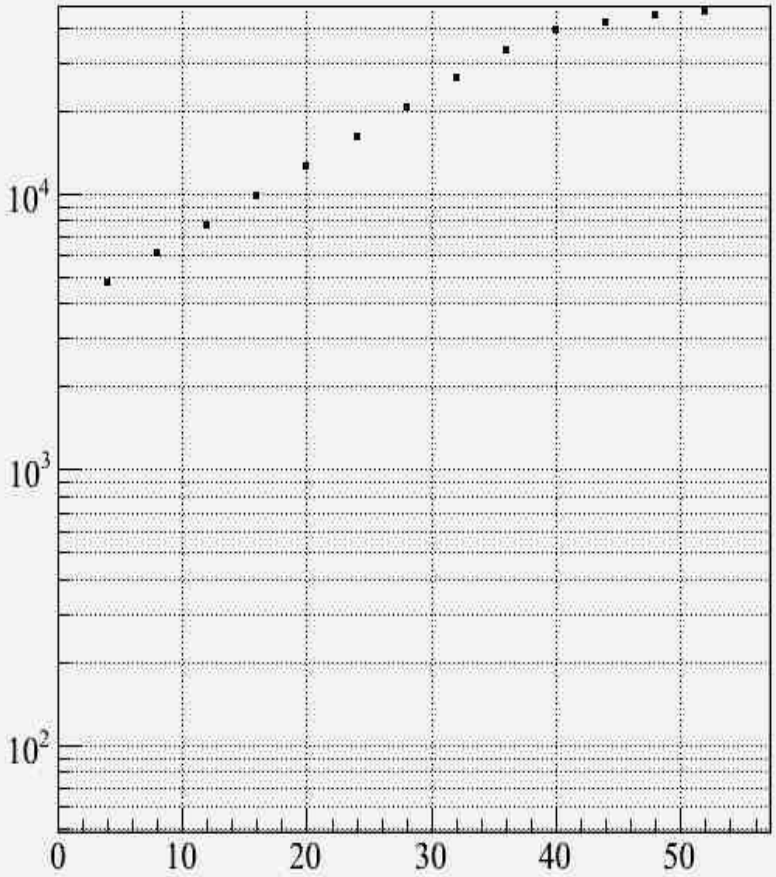
TEST CONDITIONS

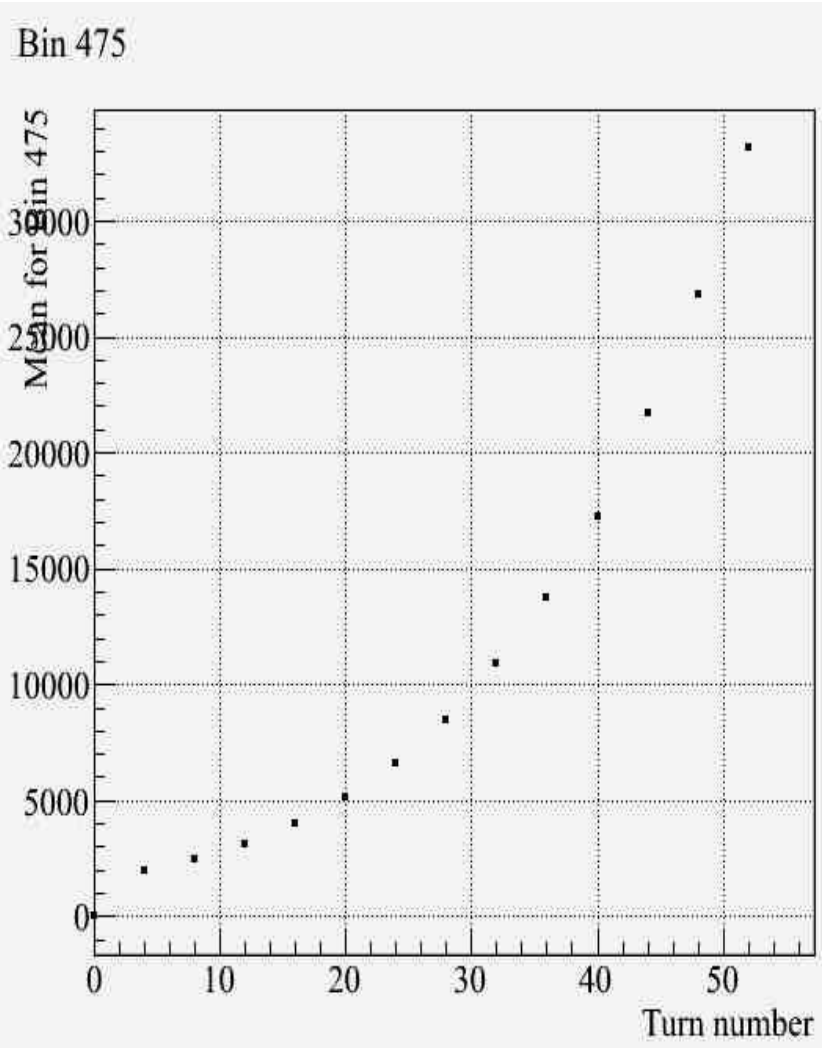


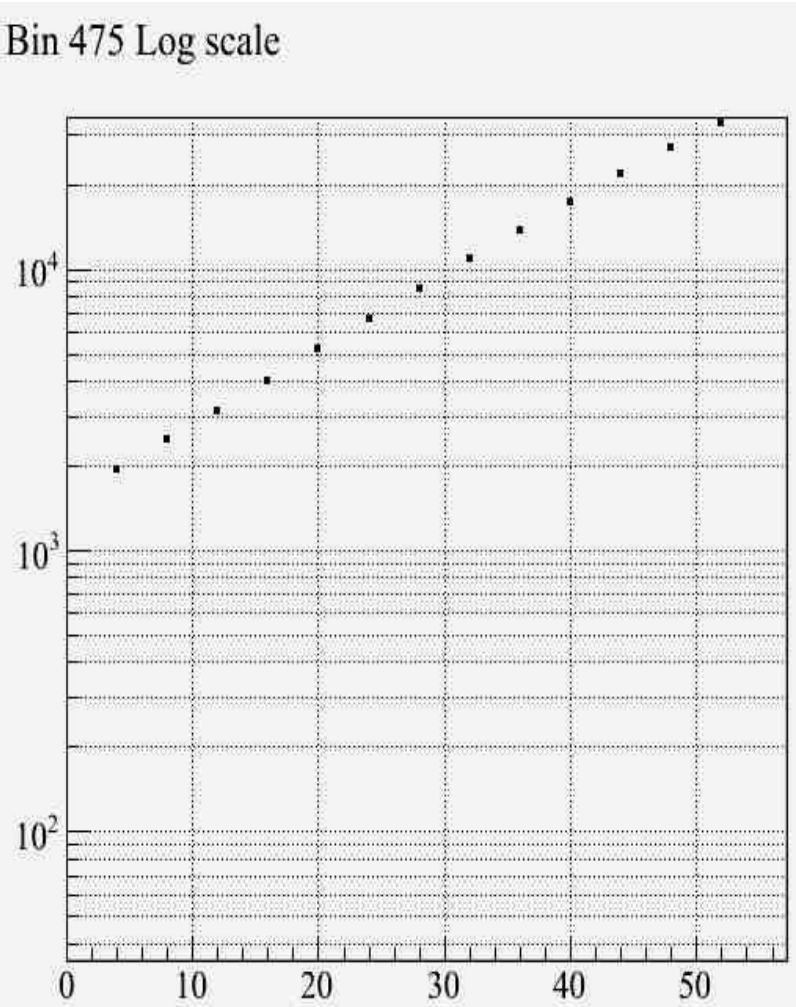
Bin 455



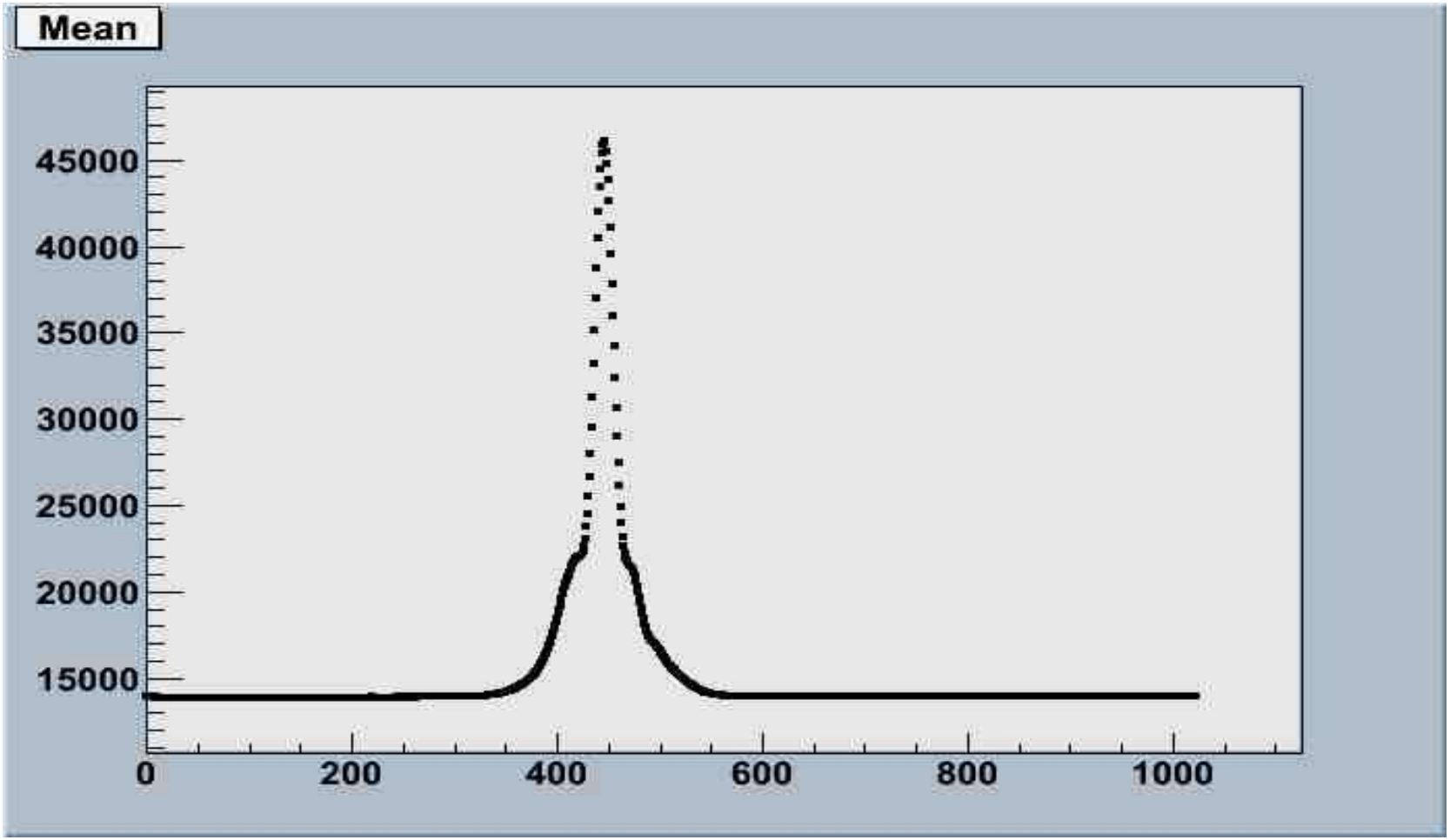
Bin 455 Log scale




Bin 475
Mean for Bin 475
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
Turn number

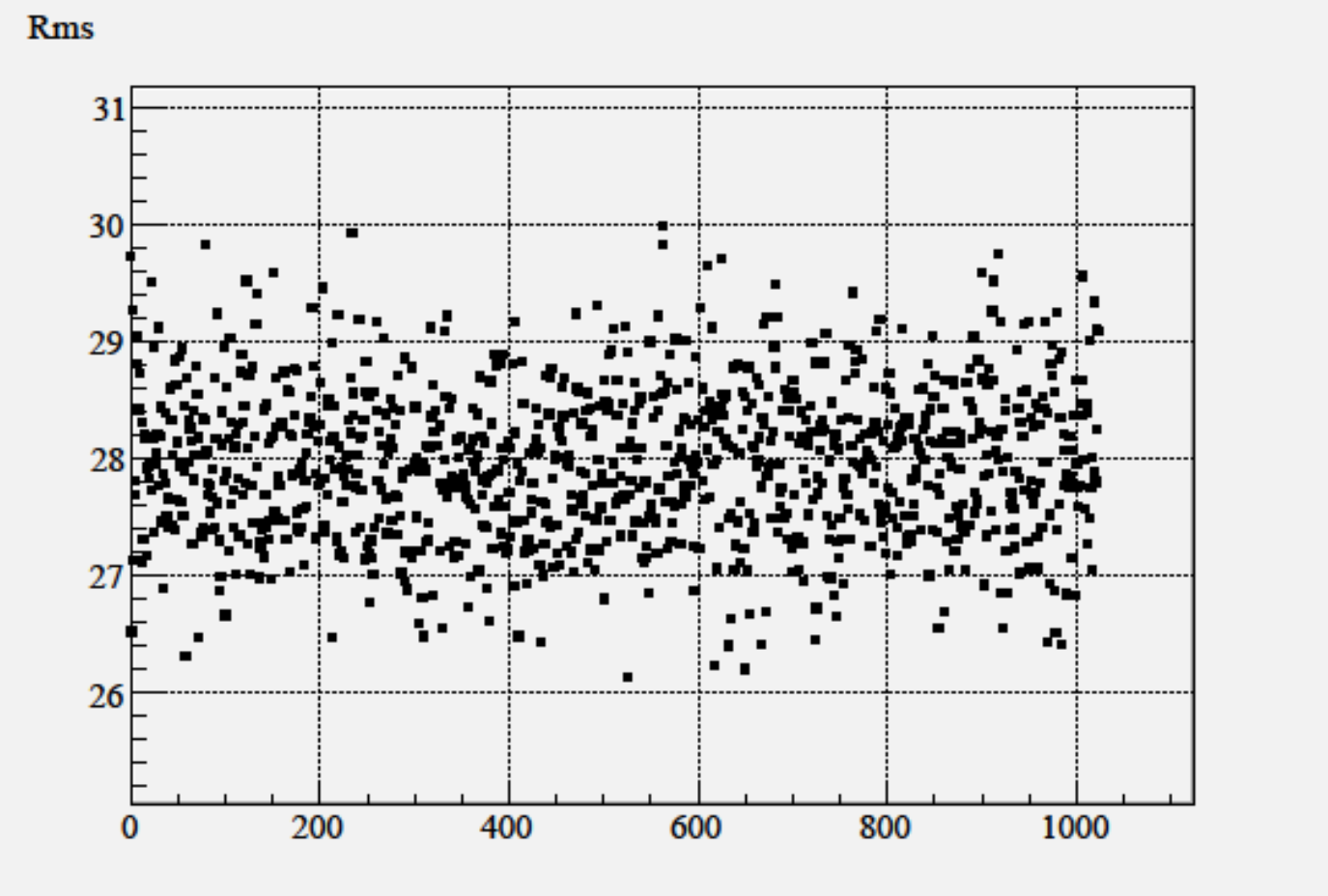

Bin 475 Log scale
10^4
10^3
10^2
0
10
20
30
40
50

CMOS PHOTO OF INCOMING LIGHT FROM FIBER

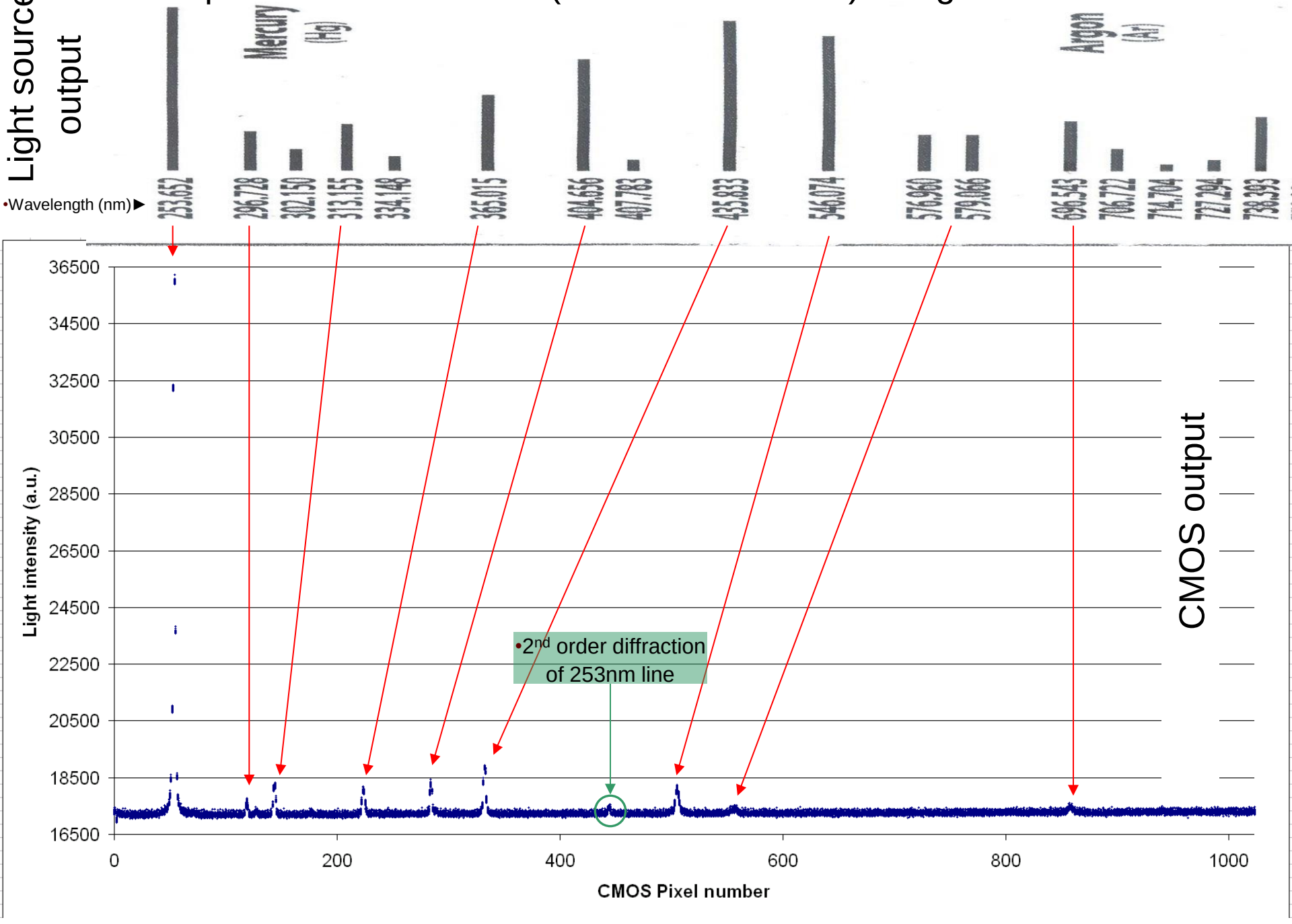


DARK RMS

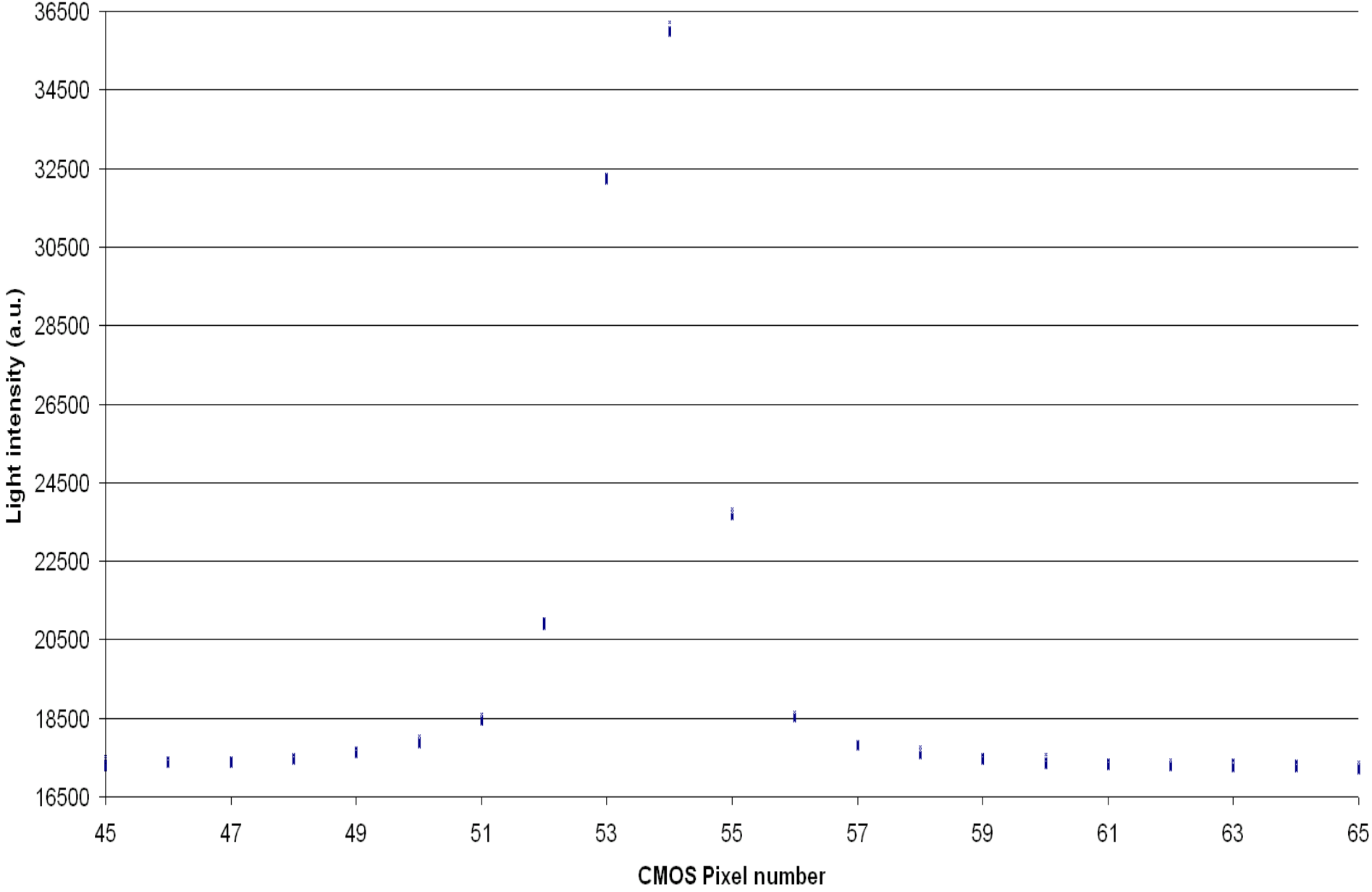
29 counts=1,5 mV



Example measurement set (32 measurements) using calibration source



•Detail picture of the 253nm peak for the CMOS readout



PROBEOIL software

Σωτηρία Δήμου

Απαιτήσεις λογισμικού για την συσκευή

- Δημιουργία interface σε γλώσσα προγραμματισμού JAVA

- Σύνδεση με την συσκευή
- Λήψη δεδομένων από την συσκευή (128, 512 η 1024 αριθμούς με endline στο τέλος του κάθε αριθμού)
- Αποθήκευση δεδομένων σε αρχείο
- Αλγόριθμος - πολλαπλασιασμός με μια σταθερά για τον υπολογισμό τιμών έντασης φωτός
- Αποθήκευση νέων δεδομένων σε αρχείο
- Μελλοντικά – Δημιουργία Διαγράμματος τιμών έντασης φωτός ανά μήκος κύματος

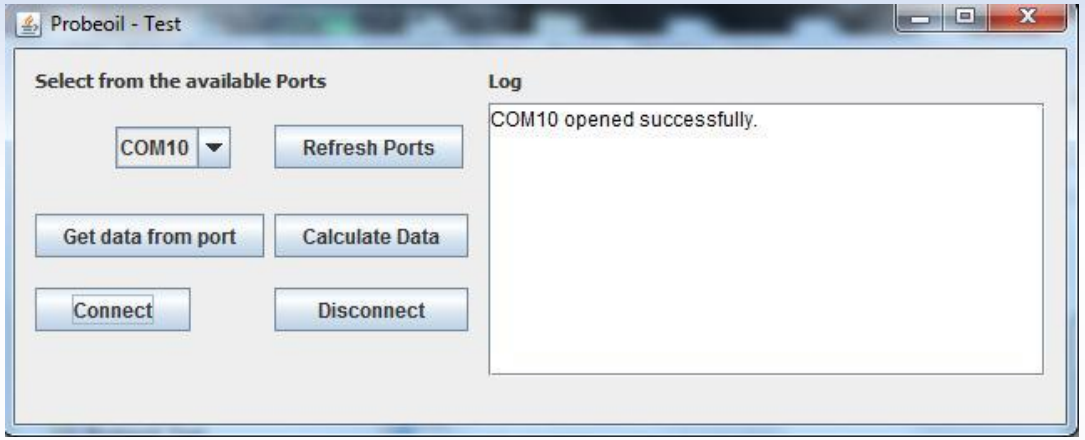
To interface

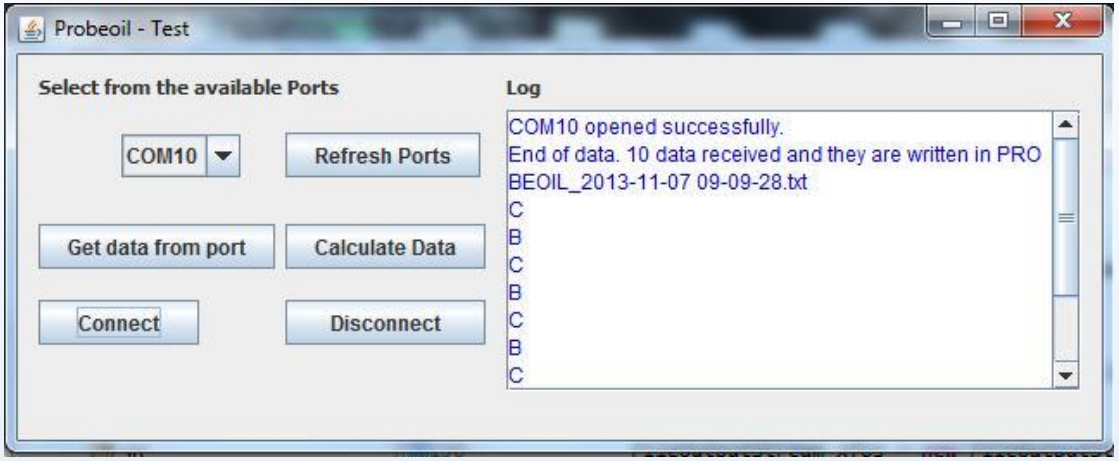
Connect – Σύνδεση με την θύρα που έχουμε επιλέξει και λήψη δεδομένων μέσω JAVA και αποθήκευση τους σε ένα αρχείο

Get data from port – Σύνδεση με την θύρα που έχουμε επιλέξει και λήψη δεδομένων μέσω C και αποθήκευση τους σε ένα αρχείο

Calculate Data – Αλγόριθμος για τον υπολογισμό τιμών έντασης φωτός και αποθήκευση τους σε ένα αρχείο

Disconnect – Αποσύνδεση από την θύρα και αποδέσμευση της





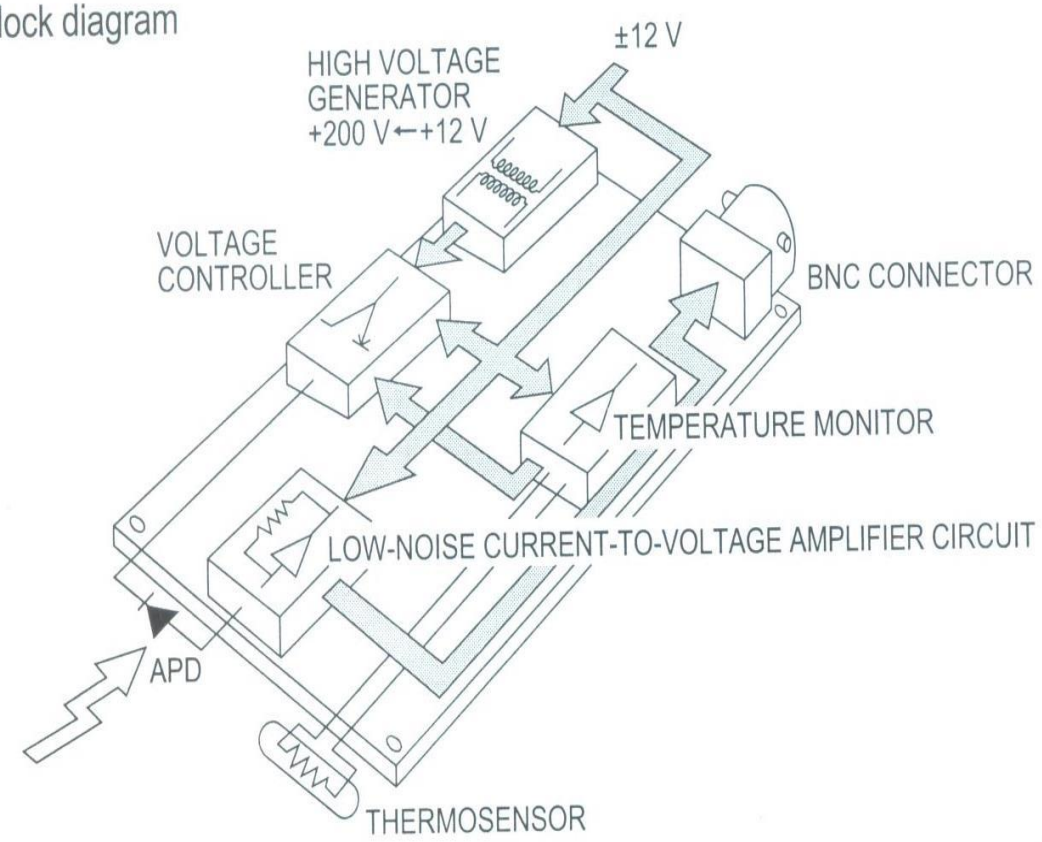
CCD SENSOR MODULE

- CCD 3648 pixels
- Spectral response 200-900 nm
- Low noise PCB 6-Layer Design
- FPGA based Data Acquisition

Under development by T.Athanasopoulos

APD MODULE

■ Block diagram



KACCC0028EA

SOLID STATE DIVISION

HAMAMATSU

IN HOUSE APD MODULE

- High Voltage module
- Temperature control module
- Signal processing(current to voltage converter, A/D converter)
- Step motor module
- Motherboard to control all peripherals

HIGH VOLTAGE MODULE

Resonant Royer Based DC/DC Converter with controlled feedback

- Controlled Output Voltage 0-250 V
- Very low ripple < 0,01 % V p-p
- Low peak on rise time

Under development by M.Maniatis, T.Domvoglou

TEMPERATURE CONTROL MODULE

- Thermo electric cooler (TEC)
- Current control circuit for TEC
- Thermo Sensor TO-220 casing
- 8-bit Slave Microcontroller

Under development by T.Domvoglou

SIGNAL PROCESSING

- Current to Voltage circuit
- 16-bit A/D Converter
- Low noise PCB

- Developed by M.Maniatis, T.Domvoglou

STEP MOTOR MODULE

- Low turn step motor < 2 degrees
- Step on X-Axis 0,5-3 mm
- Accurate positioning

Under development by M.Maniatis

Next steps

- Start sample measurements with the first prototype to evaluate its performance
- Improve the mechanics of the prototype
- Evaluate gratings with more grooves/mm for better wavelength accuracy (ordered)
- Create the first prototype for NIR spectroscopy (mechanical electronical and optical components have been ordered)
    - InGaAs photodiode 900-2500nm response
    - Pds photodiode 1000-2900nm response
- Evaluation and development of alternative sensor technologies
    - APD based module (under development)
    - CCD based module (under development)
    - Use a CMOS sensor with more pixels (under development)
    - PMT module 200-800nm response
    - MPPC module 320-900nm response