



Light weight radiation sensors

A. Giroletti*

*chiara.giroletti@bristol.ac.uk, University of Bristol, School of Physics



Abstract

Light weight radiation sensors are used for very different purposes covering a wide range of physics, engineering, geoscience and natural world applications. Their flexibility makes them ideal to be employed in various environments (even in severe conditions). They therefore have the potential to significantly impact various fields, making them very attractive for many scientific research purposes.

Physics Department at Bristol University is involved in two different light weight radiation detector projects: Dragon egg and Unmanned Air Vehicle.

Dragon egg

Concept

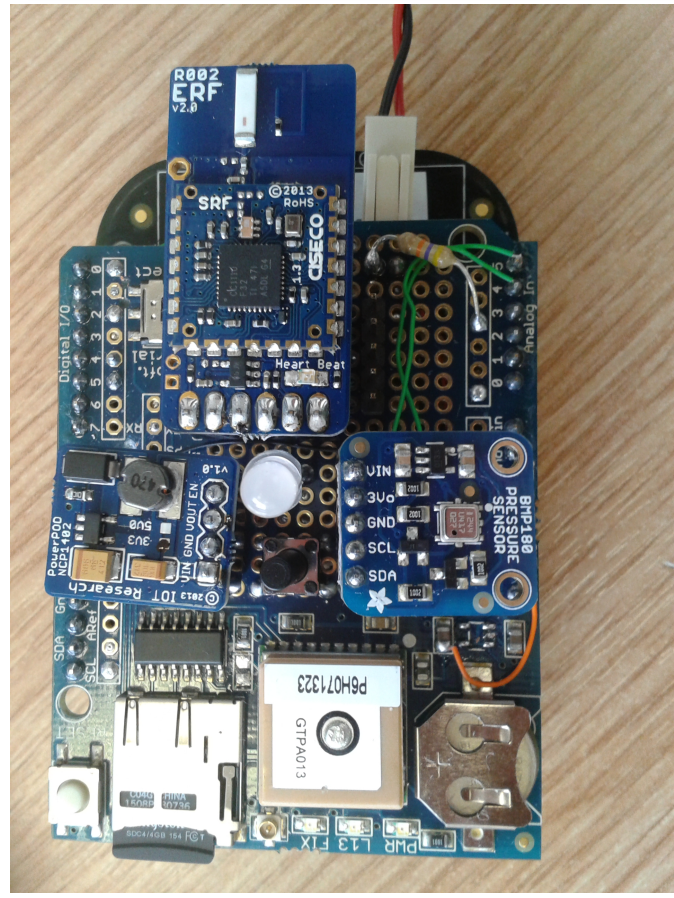


Fig 1: Due to its pliability, the PCB and sensor board can be placed in various shapes which can be determined by the dragon egg scope .



Dragon egg is based on the E-tracer concept where all electronics (memory, microcontroller, radio frequency, etc.) are placed on a single small printed circuit board (PCB), on which different sensors can be integrated.

Communication

Dragon egg communication is based on radio frequency and will work combined with a small unmanned air vehicle (SUAV). The SUAV will be responsible for placing dragon eggs in specific locations and downloading data from them.

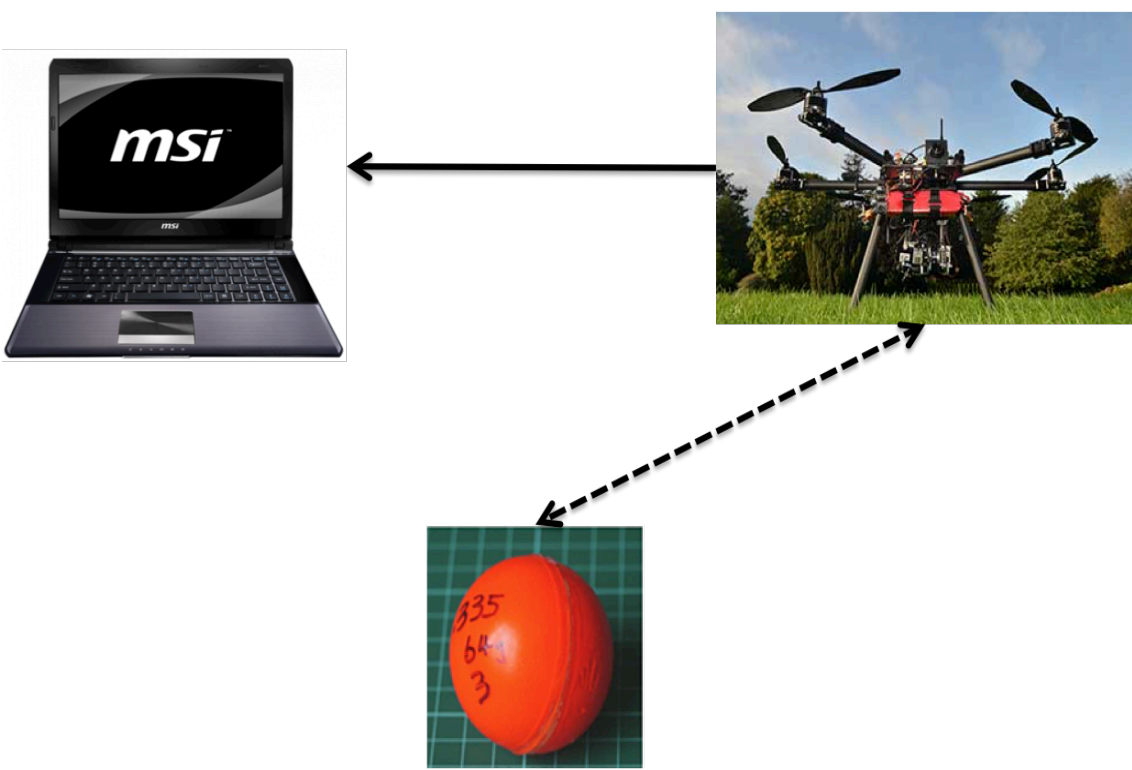


Fig 2: Communication concept: drone flies to dragon egg and, via radio frequency (100 m), collects data previously saved on a micro SD. Next the drone will return to a safe environment where data can be downloaded and analysed.

Data acquisition & Application

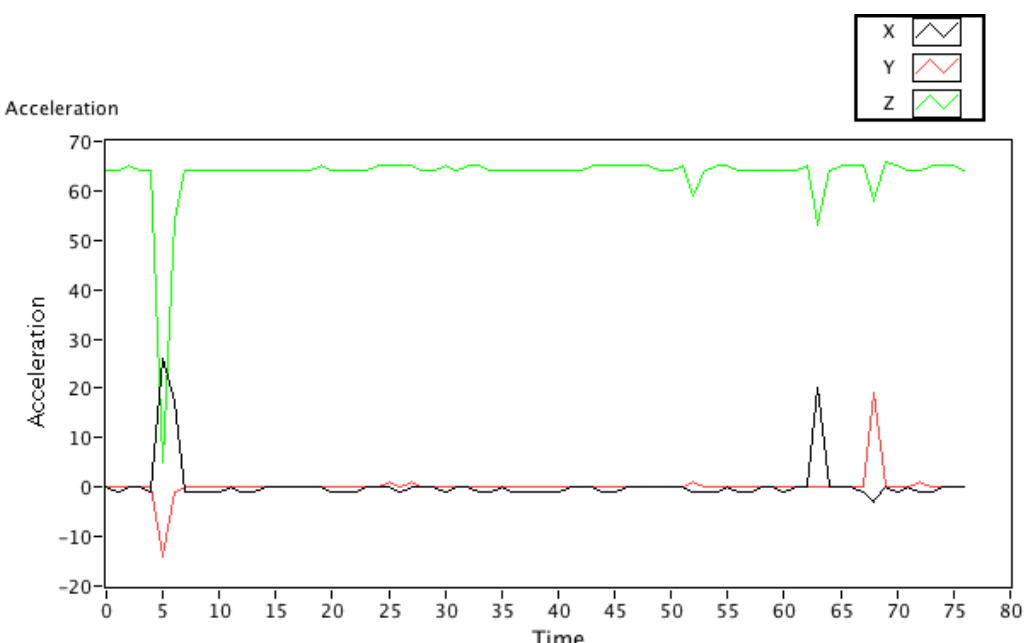
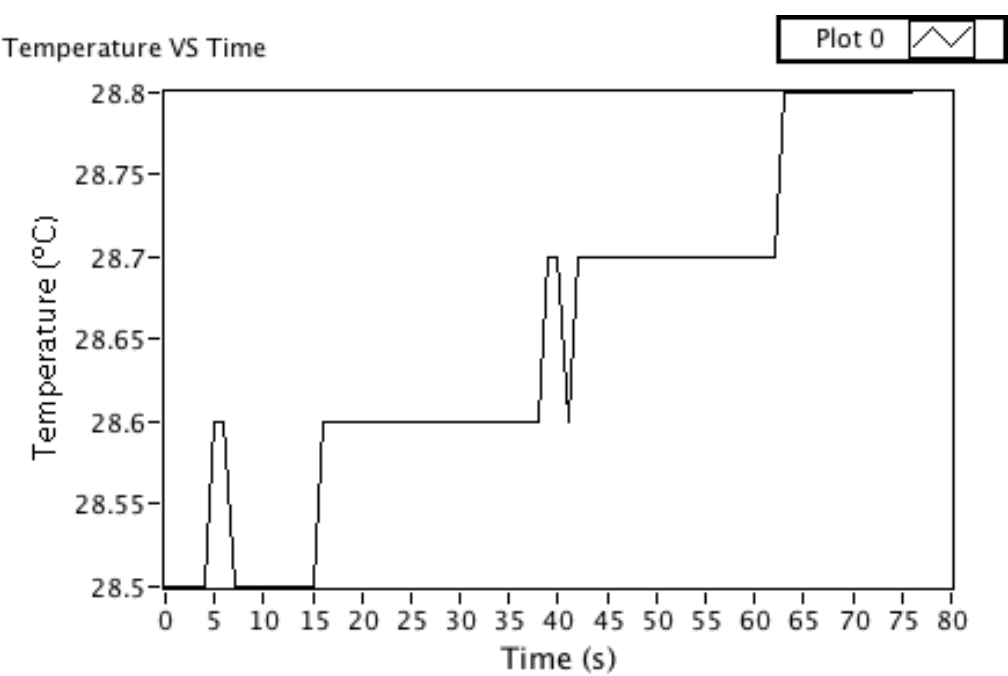
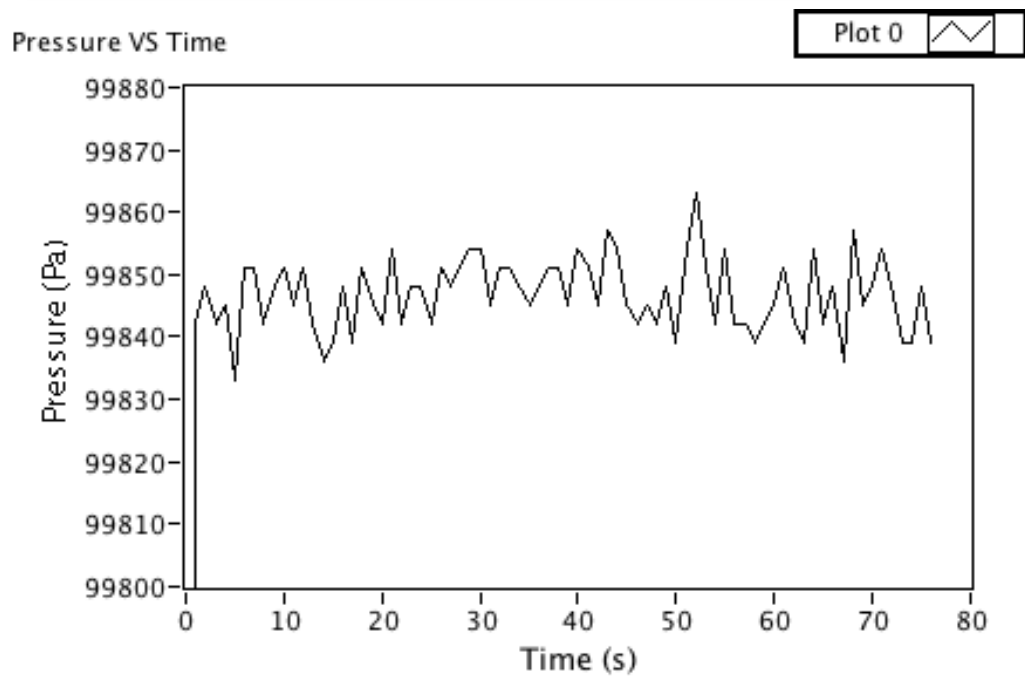


Fig 3: Example of data acquisition via LABview

Sensors on the Bristol Dragon egg prototype are:

- Pressure (barometric and external)
- temperature
- acceleration
- humidity
- radiation

TO ADD

For locating the device, GPS is included on the board as well as a micro SD card to save data.

Due to the sensor’s flexibility the applications are wide ranging and cover various different fields, such as:

- volcano monitoring
- bird incubation monitoring
- radiation detection and mapping



Unmanned Air Vehicle (UAV)

Monitoring of radiation (electromagnetic and radioactive) in severe conditions is one of the best applications of an Unmanned Air Vehicle

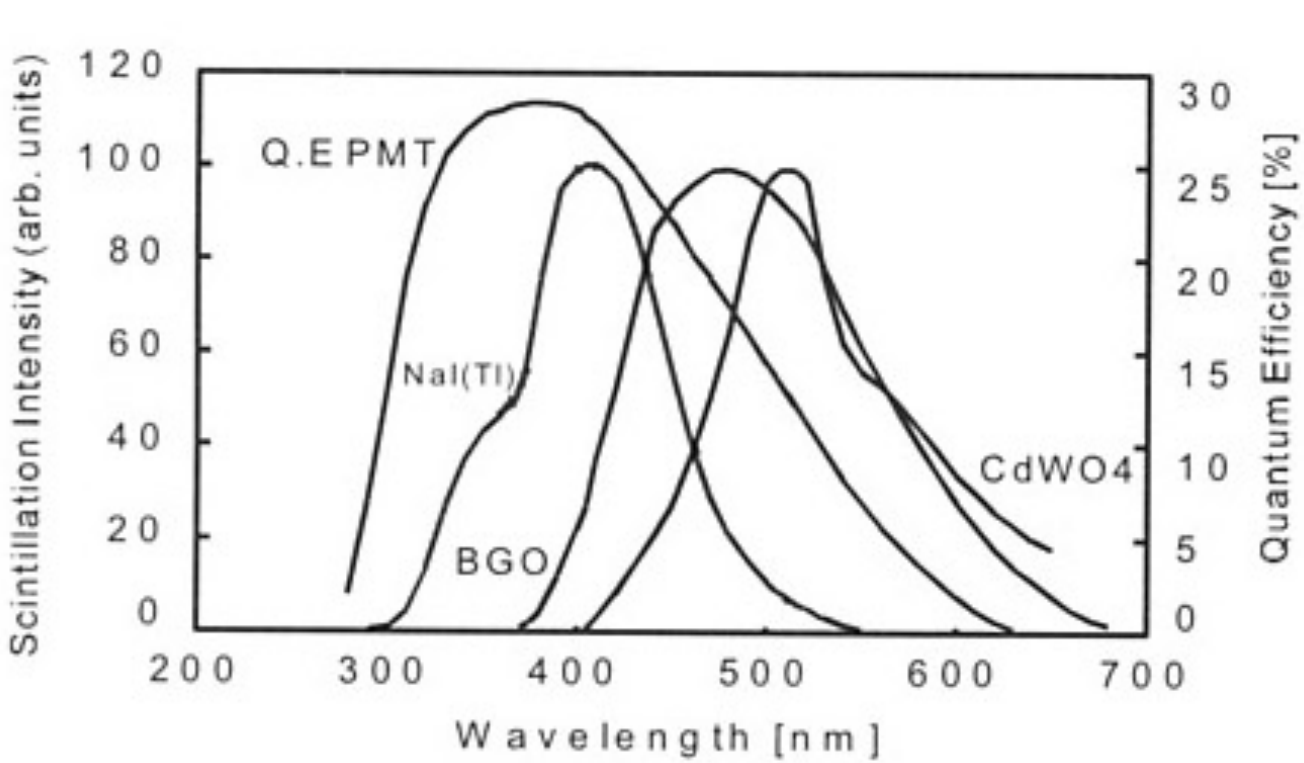
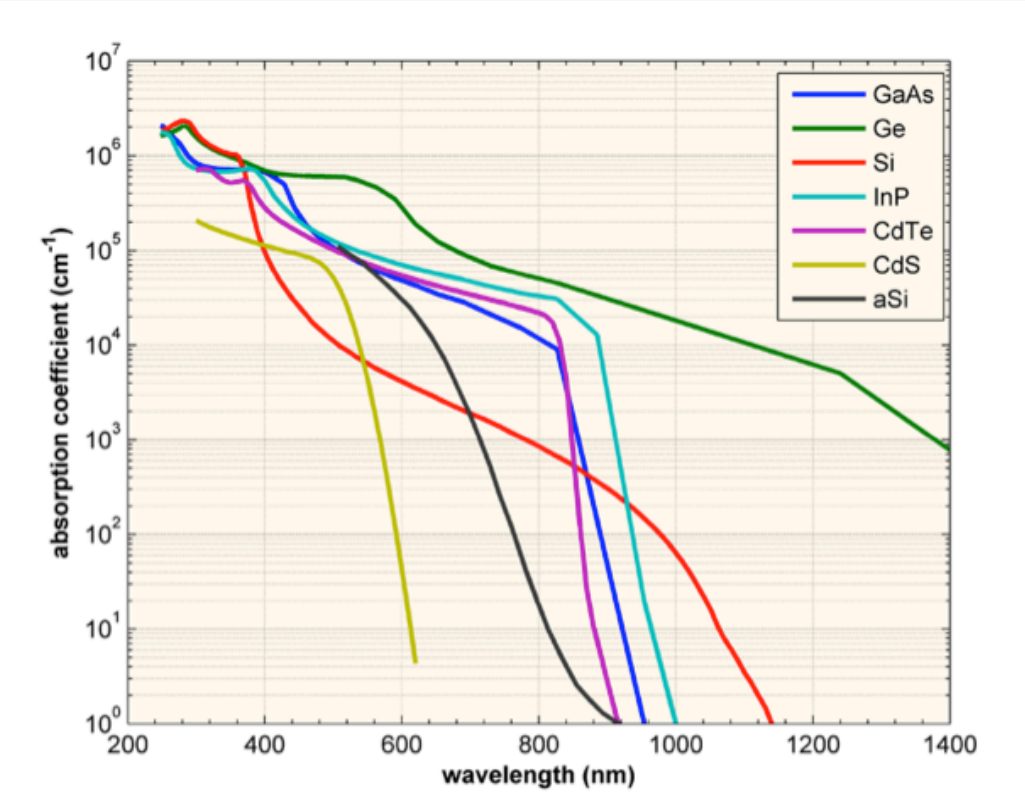


Fig 4: Wavelength range for some semiconductors and scintillators

In unknown conditions it is fundamental to understand which material can generate radiation and the energy of any generated particles (neutron, β , γ). Due to this it is essential to cover the widest range of energies. For this reason we employ a combination of semiconductors and scintillator detectors.

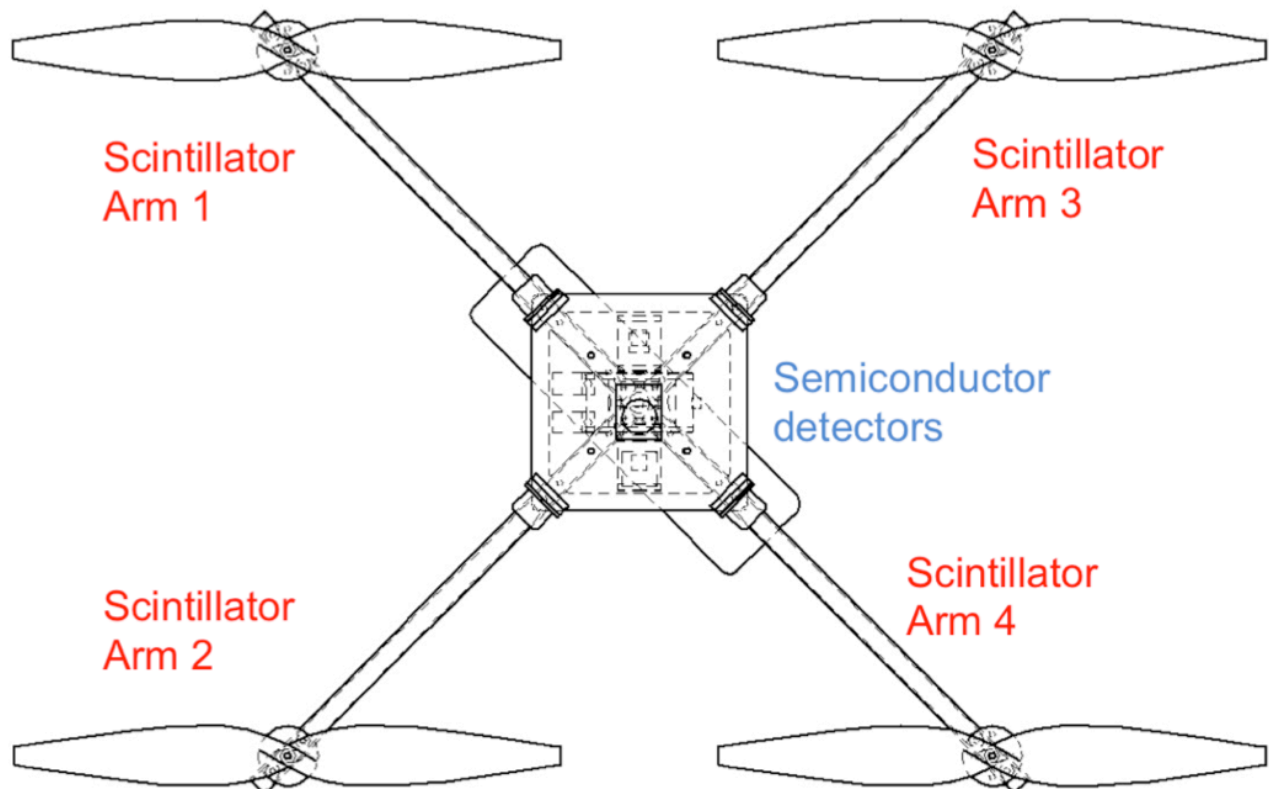


Fig 5: Quadcopter detectors scheme.

| SEMICONDUCTOR | SCINTILLATOR |
|---------------------------|-------------------------|
| High radiation resistance | Fast time response |
| Relatively low weight | Detect particle energy |
| Good resolution | Detect neutron |
| Good efficiency | Elevated stopping power |