ALIBAVA

SYSTEMS

EASY

Educational Alibava System

The Alibava System

ALIBAVA (**A LI**verpool, **BA**rcelona and **VA**lencia) System

is the first compact and portable system for the characterization of microstrip semiconductor radiation detectors.

PLUG&PLAY works with Windows, Linux and Mac OSX

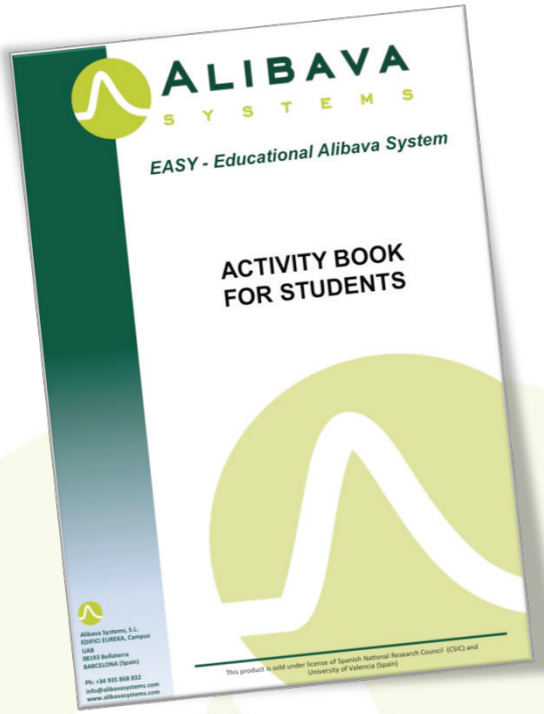
Developed by

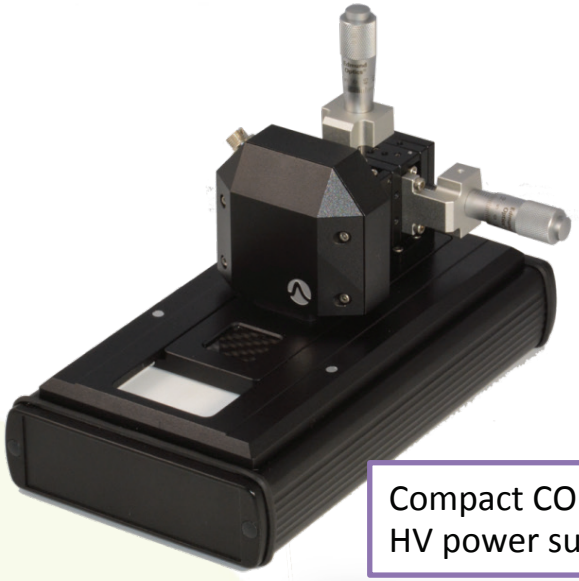
University of **LI**verpool, CNM-IMB in **BA**rcelona and IFIC in **Va**lencia**.**

The development was supported by **CERN-RD50** to find the technology for the silicon sensors in the trackers for the HL-LHC.

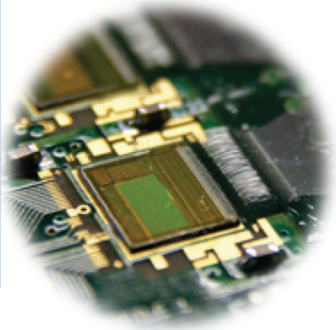
The system is used by over 30 particle physics institutes in Asia, Europe and USA.

EASy – Educational Alibava SYstem

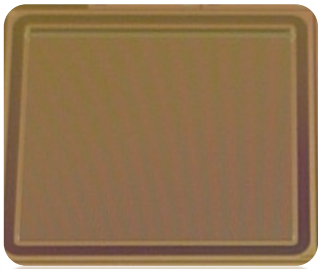




DETECTOR board with micro positioners to scan strips with source and laser and self trigger



Compact CONTROL BOARD with HV power supply



Laser

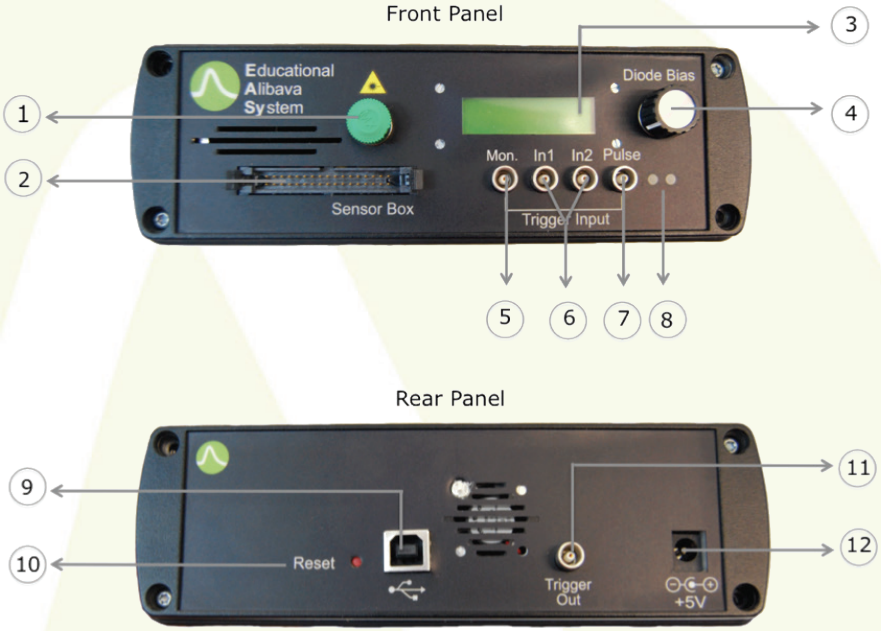
We have prepared an “educational version” of it suitable to make experiments with silicon detectors at the lab.

THE CONTROL UNIT

A control unit, the only object that needs to be plugged into the wall socket.

- ❑ Provides de HV for the sensors and measures the sensor current.
- ❑ Has a laser system to test the sensors.
- ❑ Has the “brain” the controls the whole system according to the commands from the DAQ software

Dimensions: 169×52×120mm3 (W×H×D)

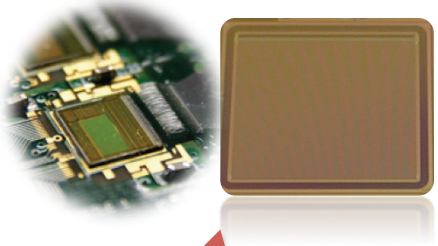


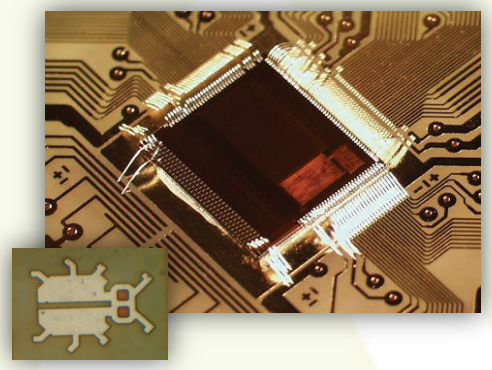
Laser source

- Wavelength: 980nm.
- 5ns Pulses width
- Optical fibre output.

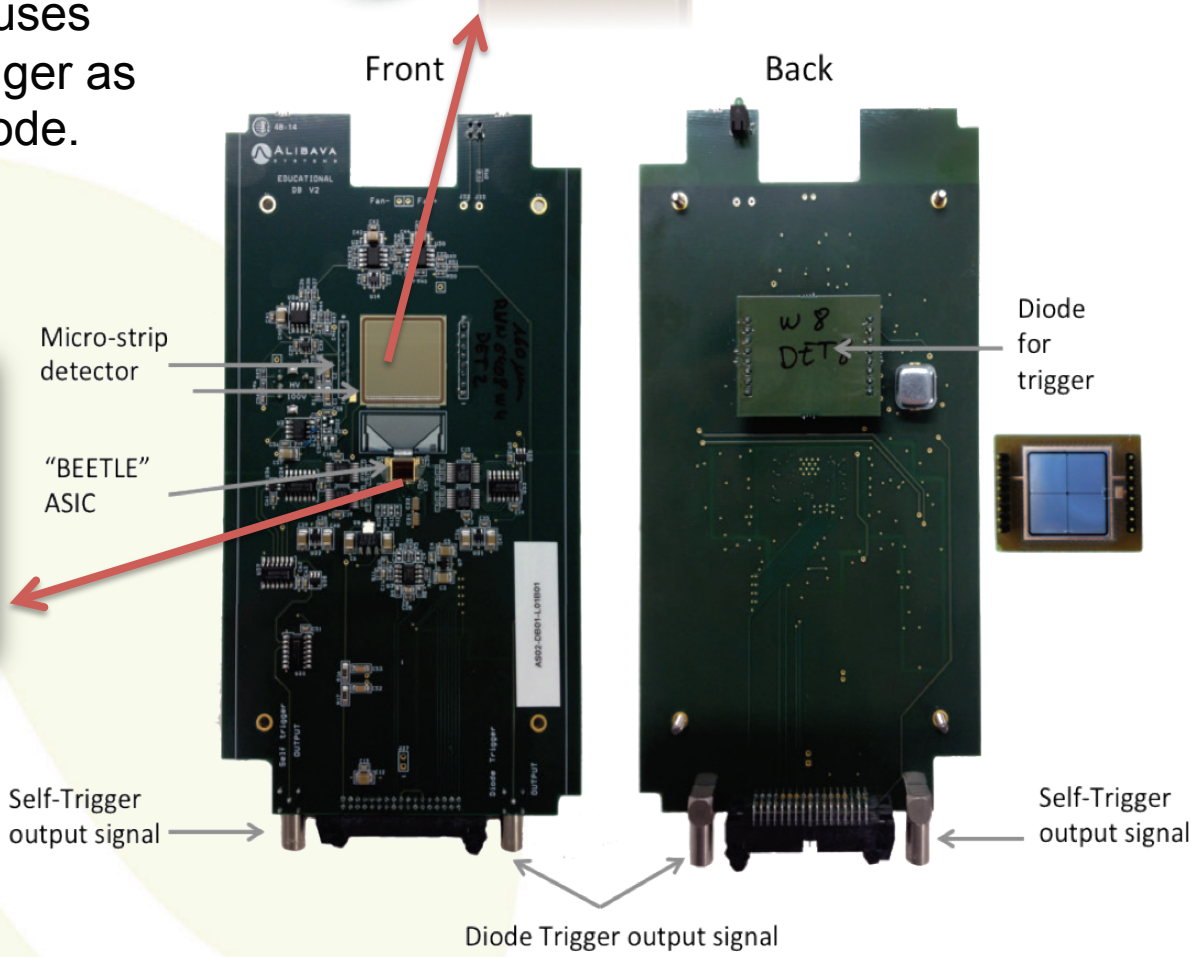
THE SENSOR UNIT

Contains the sensor, the front-end electronics and a diode to provide a trigger for the acquisition. It also uses the Beetle chip self-trigger as an alternative to the diode.



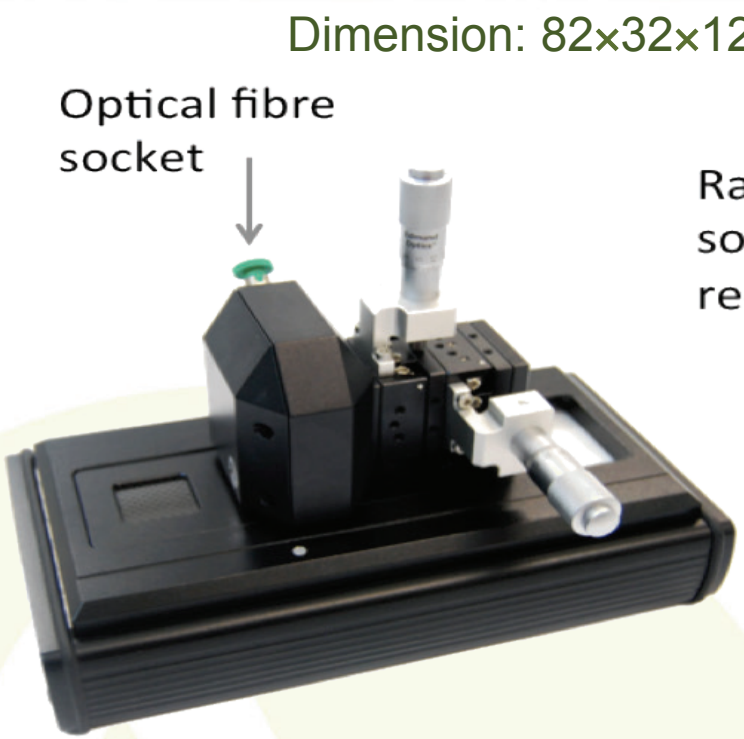


Beetle: Developed for LHCb

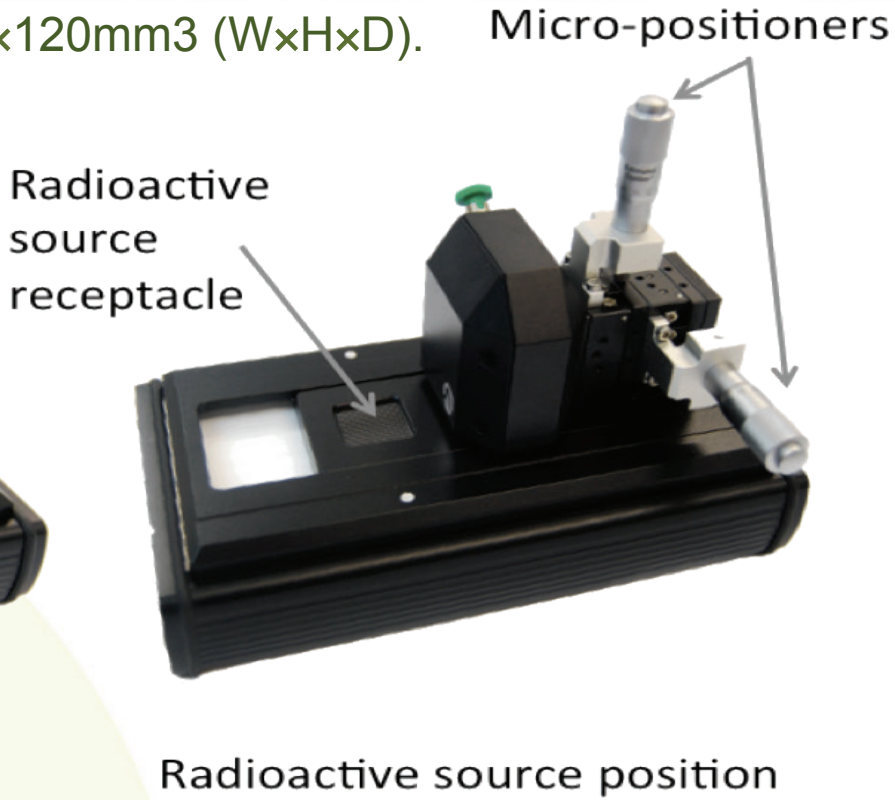


THE SENSOR UNIT

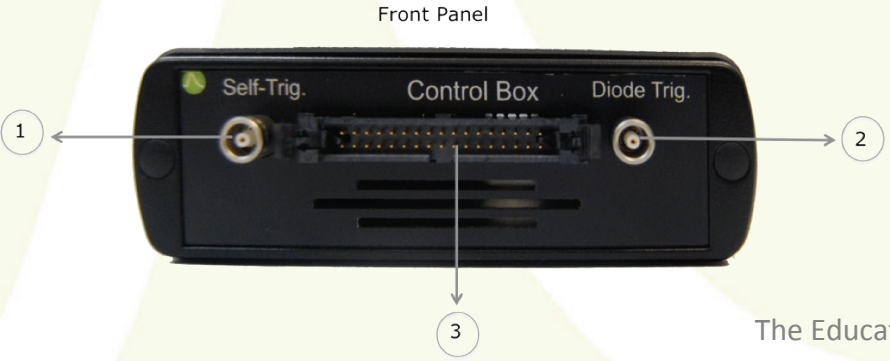
Dimension: 82×32×120mm3 (W×H×D).



Laser position



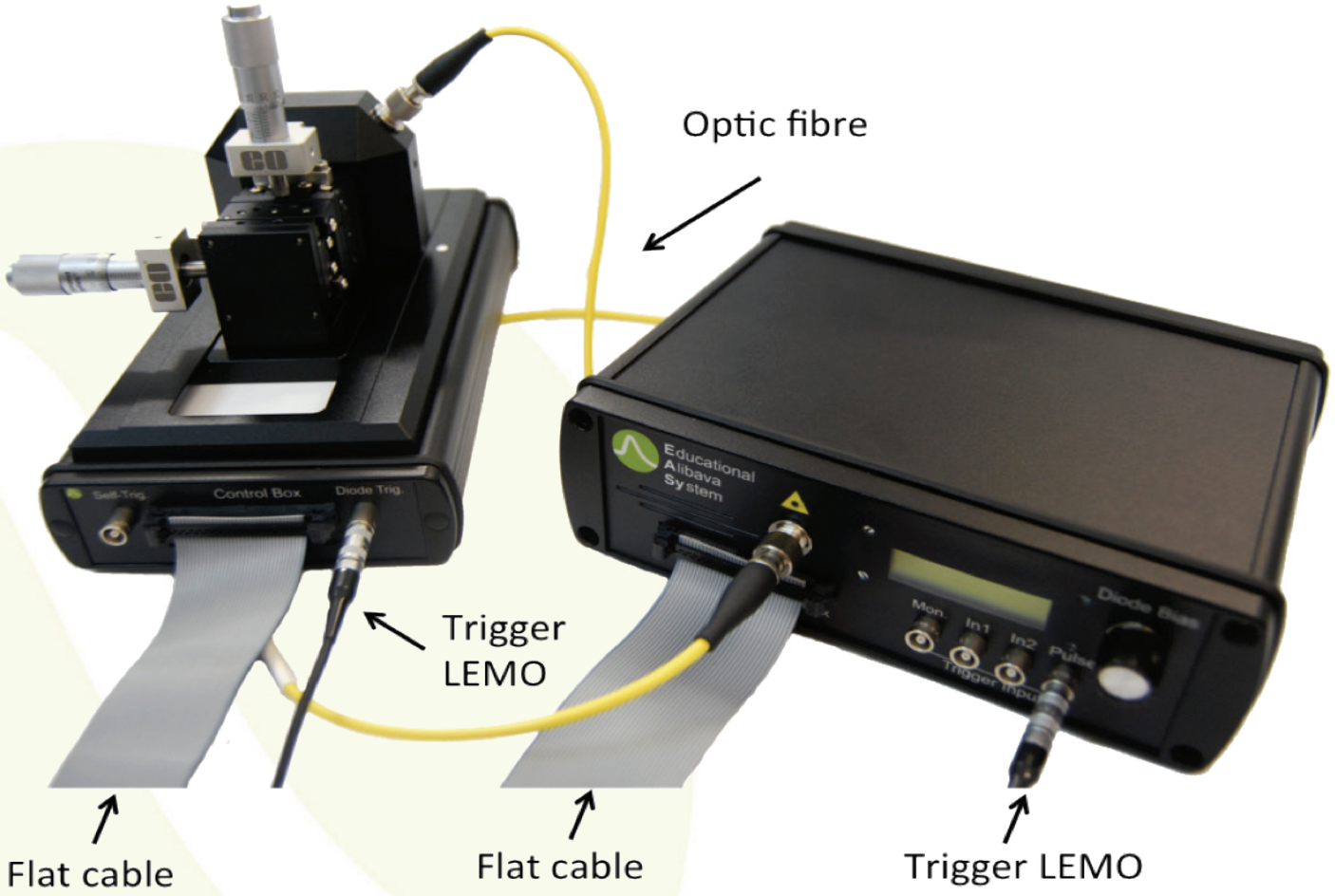
Radioactive source position



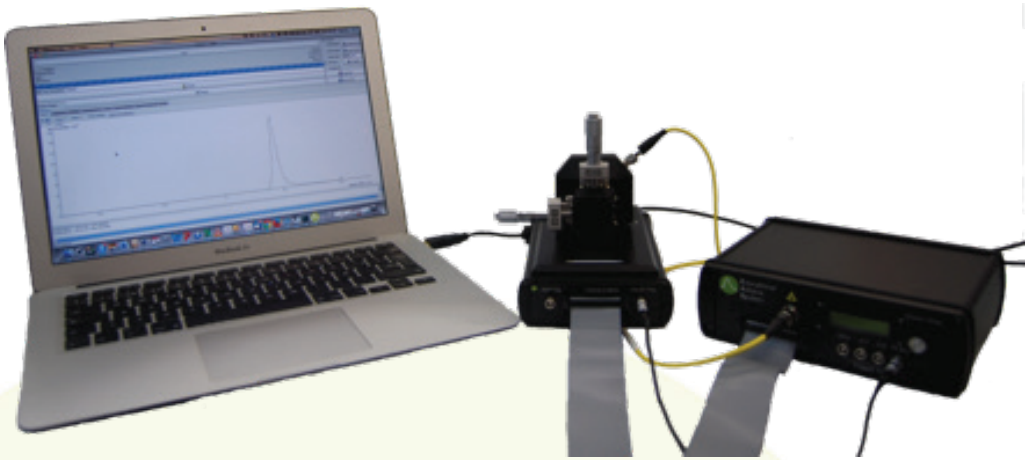
With the micropositioners we can "hit" different channels or positions between channels with both the laser and the radioactive source.

THE EASY SYSTEM

All the parts together.
Connected to the computer via USB 2.0



The System in a Box

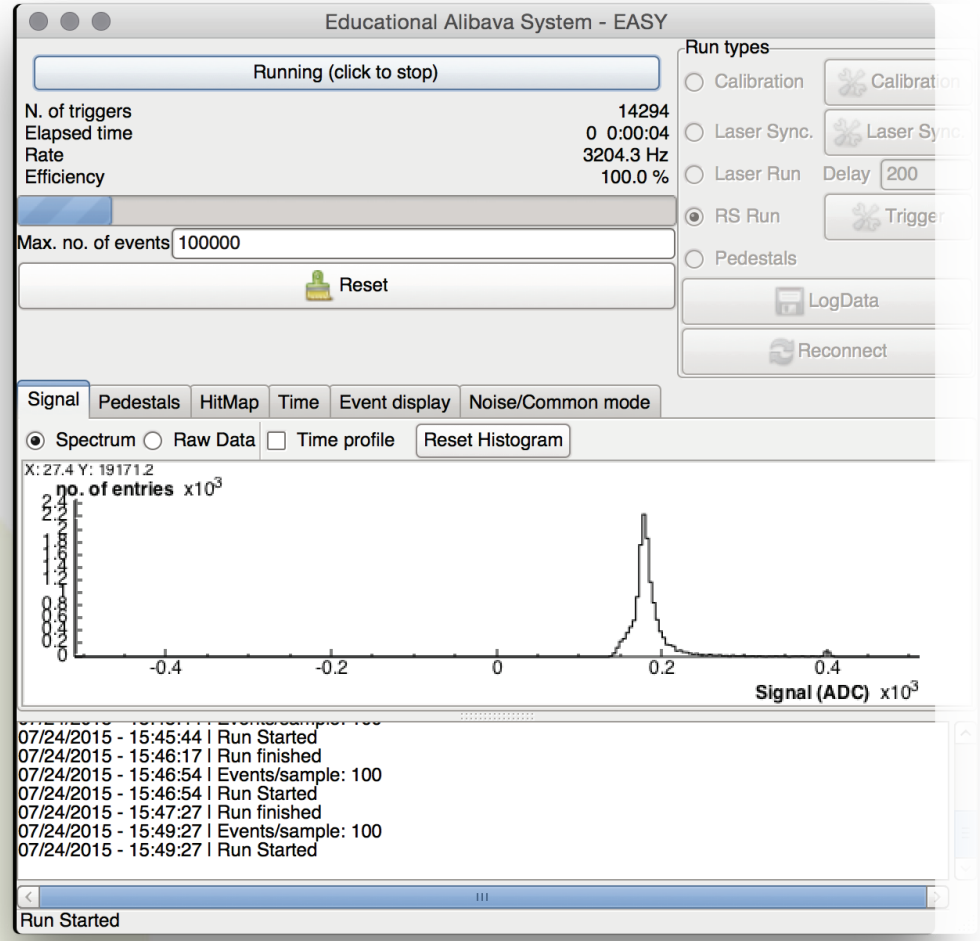


THE DAQ SOFTWARE

Acquisition software

The system includes a specific data acquisition software and data analysis tools to demonstrate and visualize the operating principles of the silicon strip detector.

SPECTRUM



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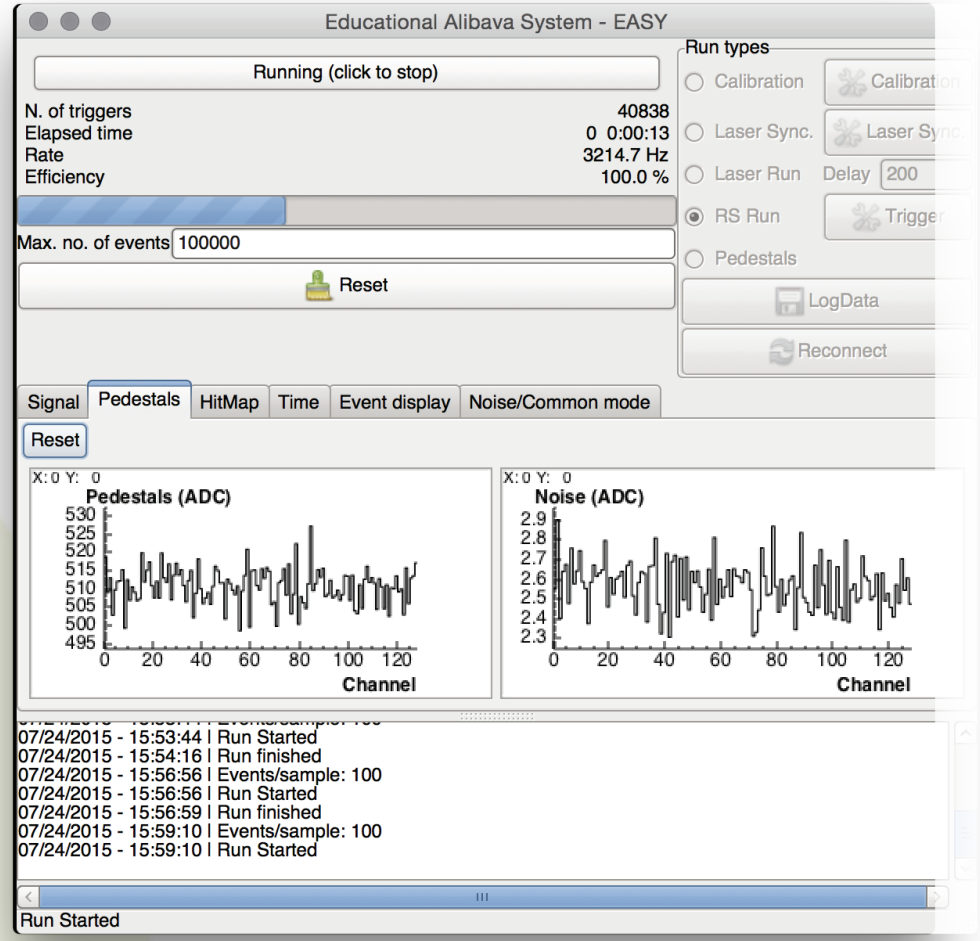

PEDESTALS

THE DAQ SOFTWARE

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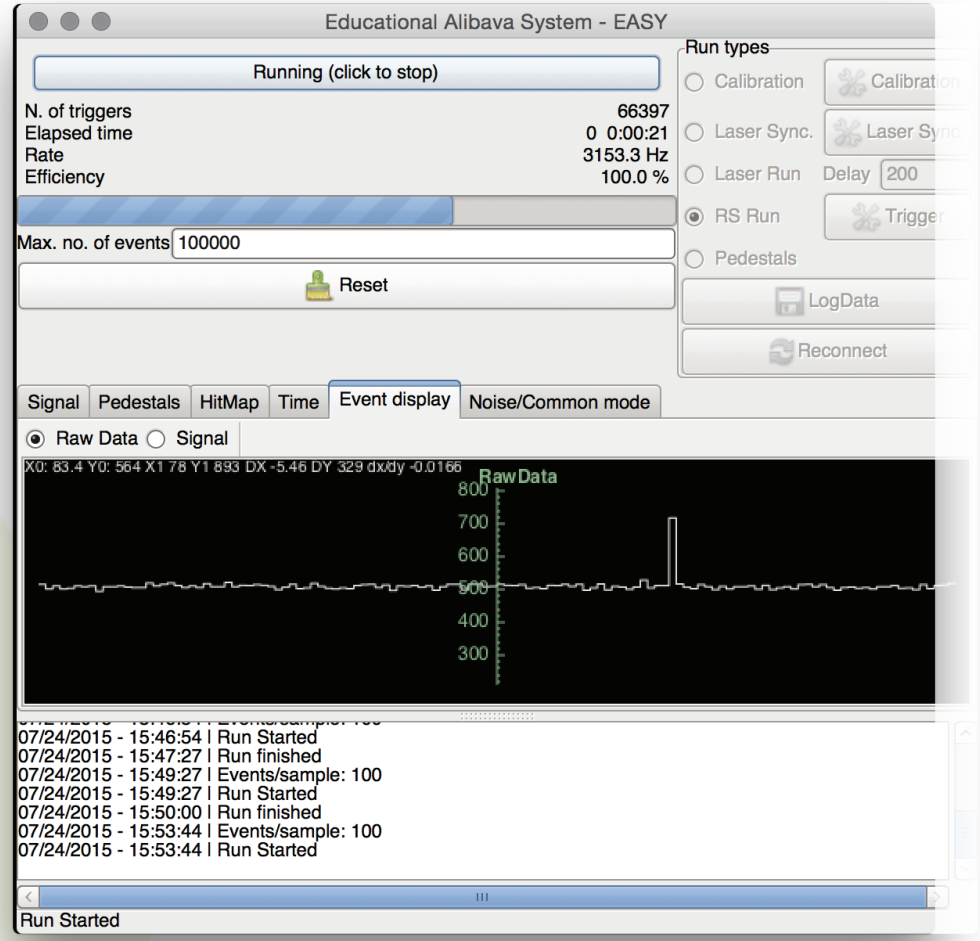
EVENT DISPLAY



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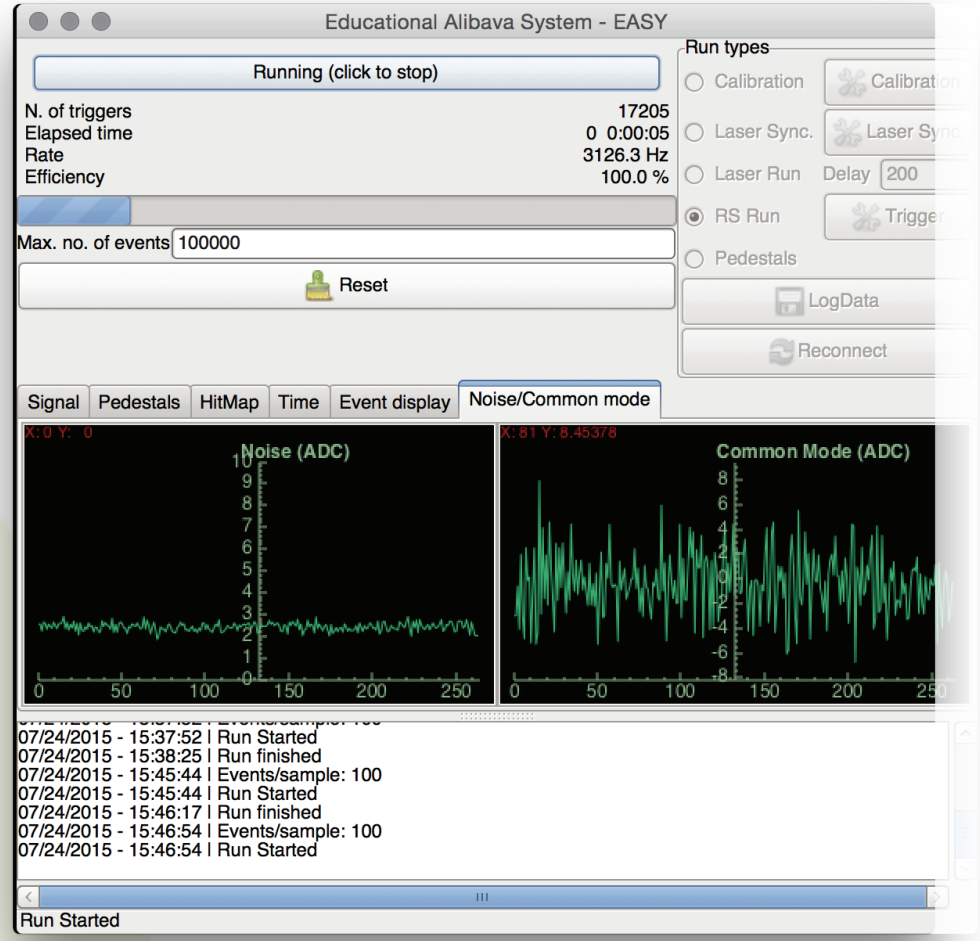
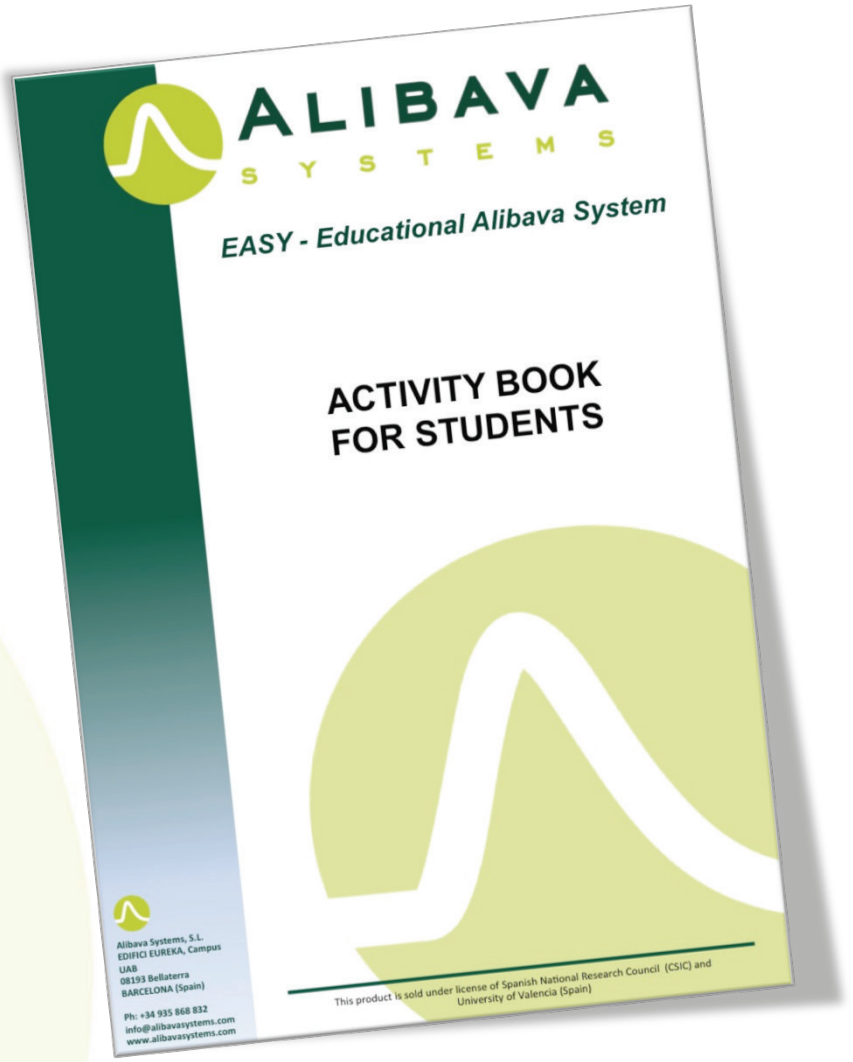


User's manual and Exercises book

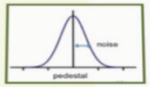
The kit incorporates the user manual and a specific exercises book ideal for introducing the student on the high energy physics/ particle physics experiments.



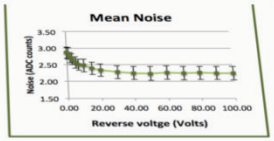
EASy Experiments

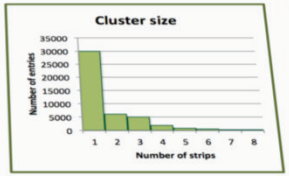
Signal and Noise

The students will be introduced to the concepts of **pedestals**, **noise** (its dependence of the noise with the reverse voltage), **cluster size** and **signal to noise ratio** (SNR). This is an important aspect from the operational point of view to distinguish the genuine signals from the electronics noise.



Pedestals and noise

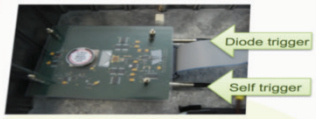


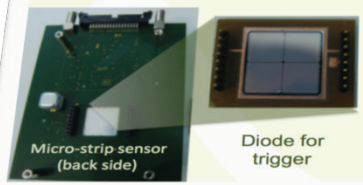


Trigger modes

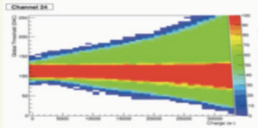
The EASY system includes tow trigger modes :

- **Diode mode**: suitable for minimum ionising particles crossing the detector.
- **Self trigger**: suitable for particles absorbed in the detector.





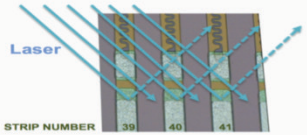
Diode for trigger

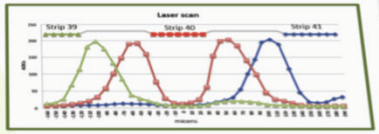


Threshold scar of an individua channel for the self trigger

Strip structure, charge sharing and position resolution

The EASY system includes a pulsed laser to study to structure the strips. Depending on the point of incidence of the charge collected can be shared between adjacent strips. Students can investigate the effect of charge sharing in the position resolution of a strip detectors.

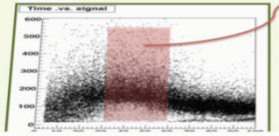


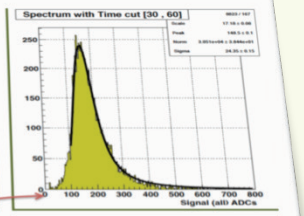


LASER MODE

Passage of particles through matter

The signal formation in the silicon sensor is due to the ionizing energy loss of the incident particles. The EASY system allows studying the collected charge and the analysis software displays the histogram, which finally is fitted using a Landau distribution convoluted with a Gaussian.



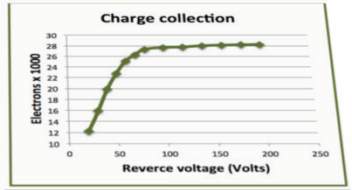


Charge deposition and pulse reconstruction of a **mip** particle (Sr90)

DIODE TRIGGER MODE

Charge collection, depletion voltage and electric field

The incident particle creates electron-hole pairs all along its pass through the sensor bulk. But only those pairs created in the depletion region contribute to the signal thanks to the electric field, which drifts them away. Therefore the signal depends on the size of the depletion region.



Increasing of charge collection with the depletion voltage for a mip particle (Sr90) in a 300µm strip detector.

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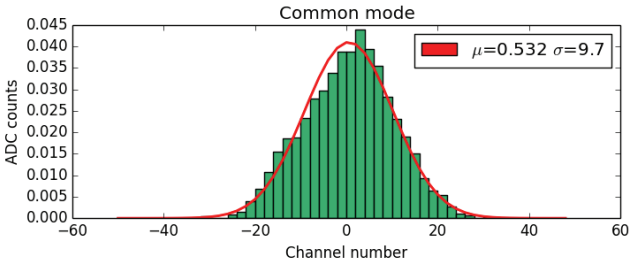
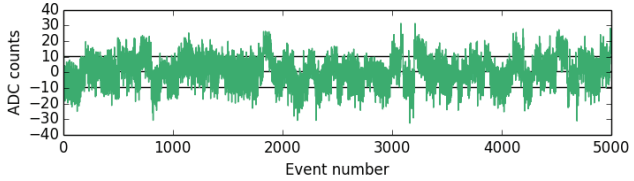
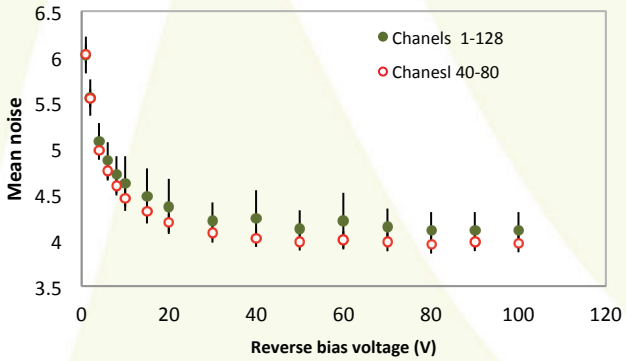
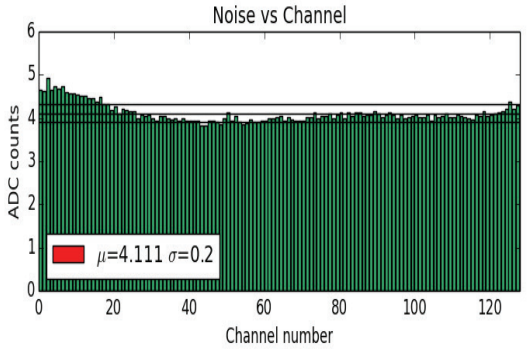






Noise .vs. V_{dep}



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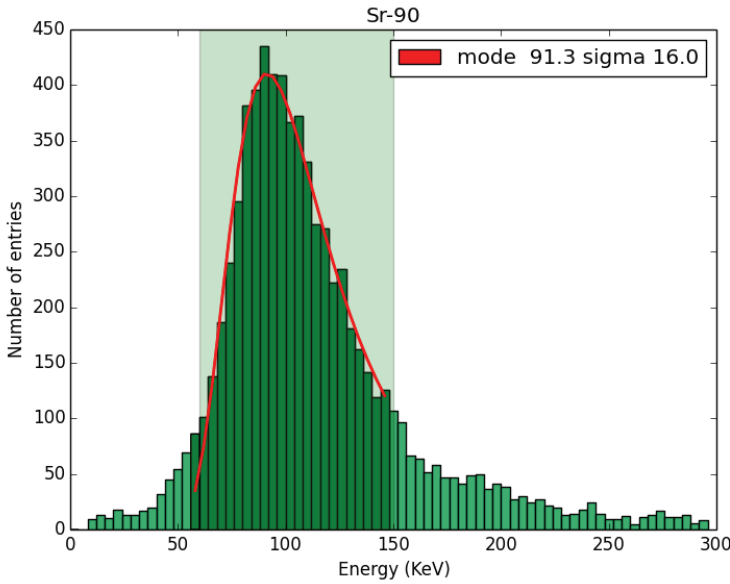
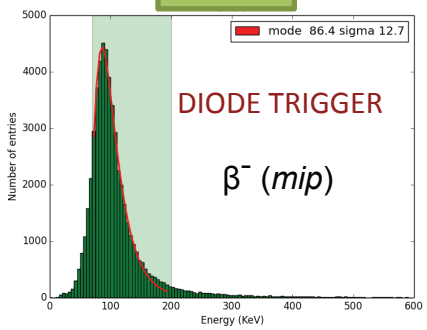
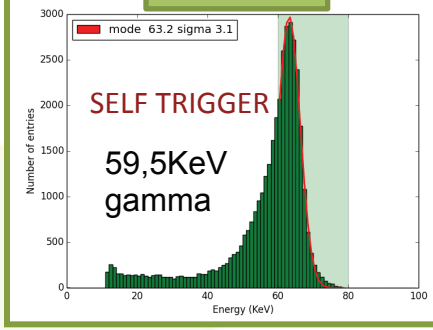


Energy deposition of a gamma, beta and X-ray sources

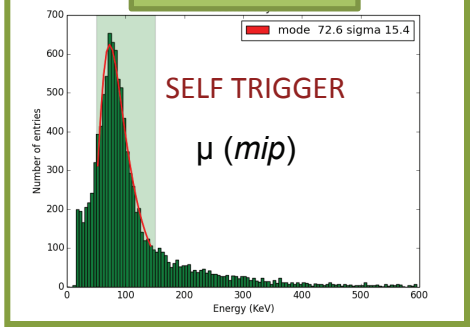
Sr-90



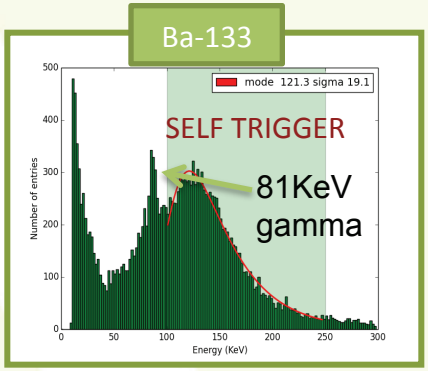
Am-241



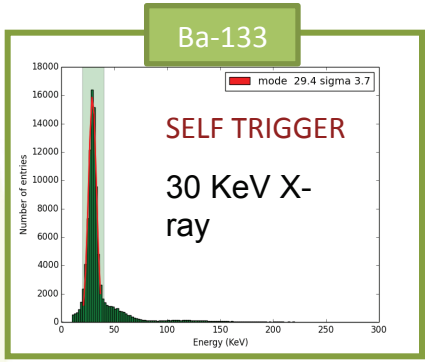
Cosmic rays



Ba-133



Ba-133



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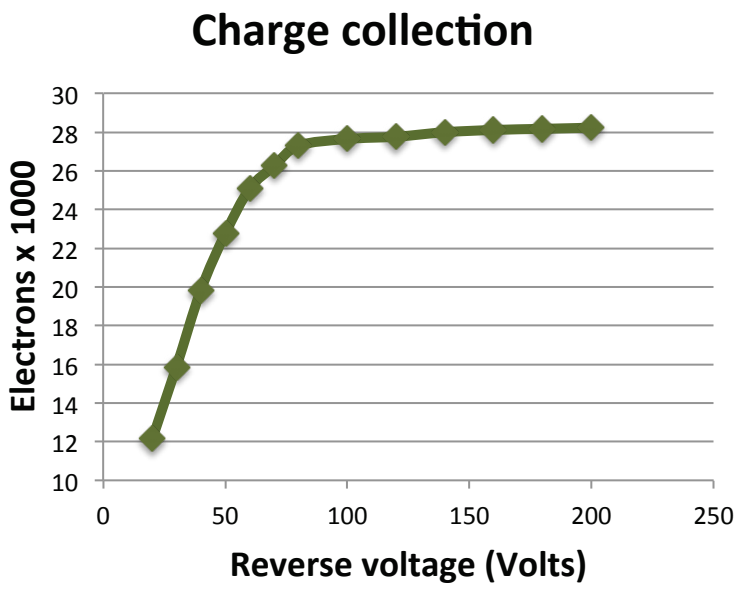

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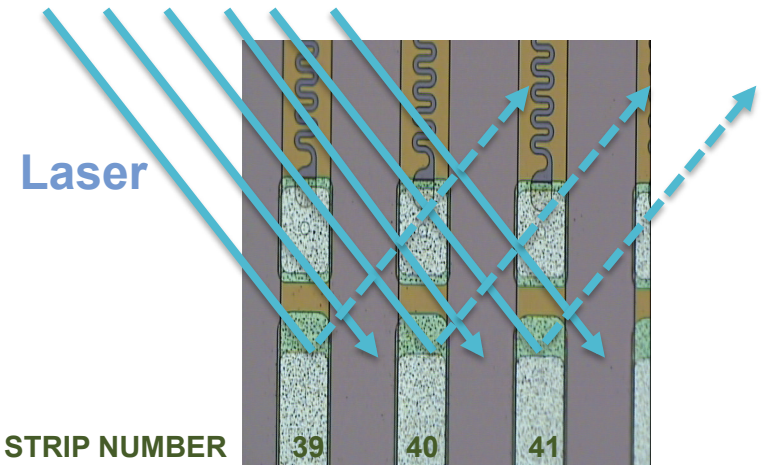

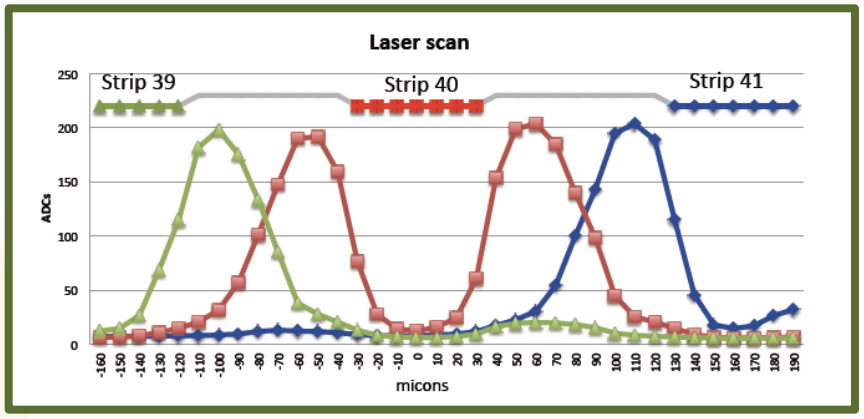

LASER MODE

EASY
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The system is a perfect tool to learn about the signal formation in semiconductor sensors and its processing.

Ideal for Physics and Engineering students following courses on radiation detection instrumentation.

ALIBAVA
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(www.alibavasystems.com)

info@alibavasystems.com