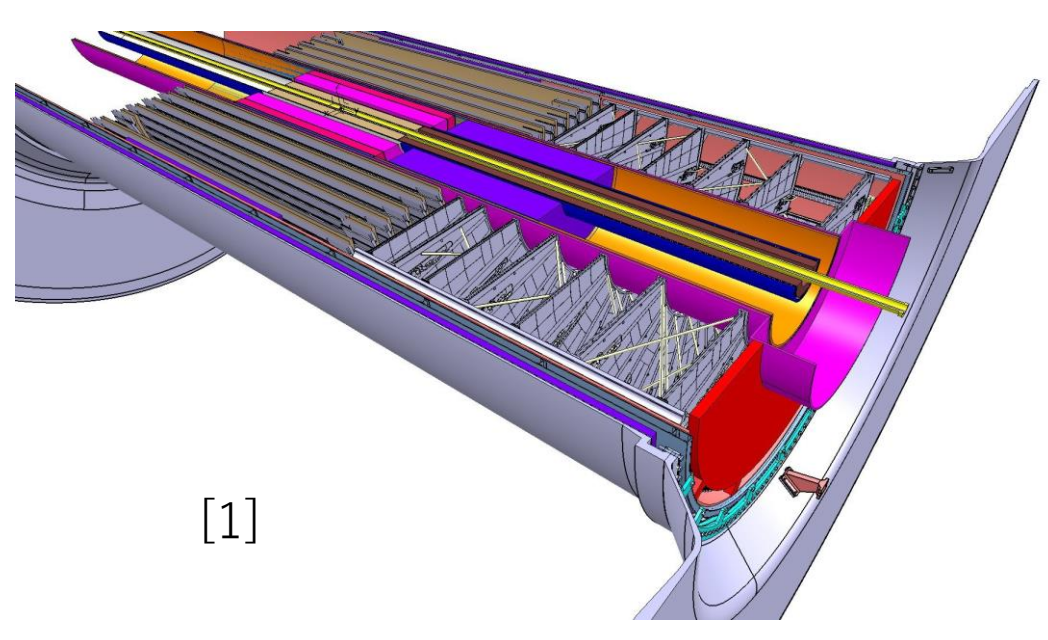


ATLAS ITk



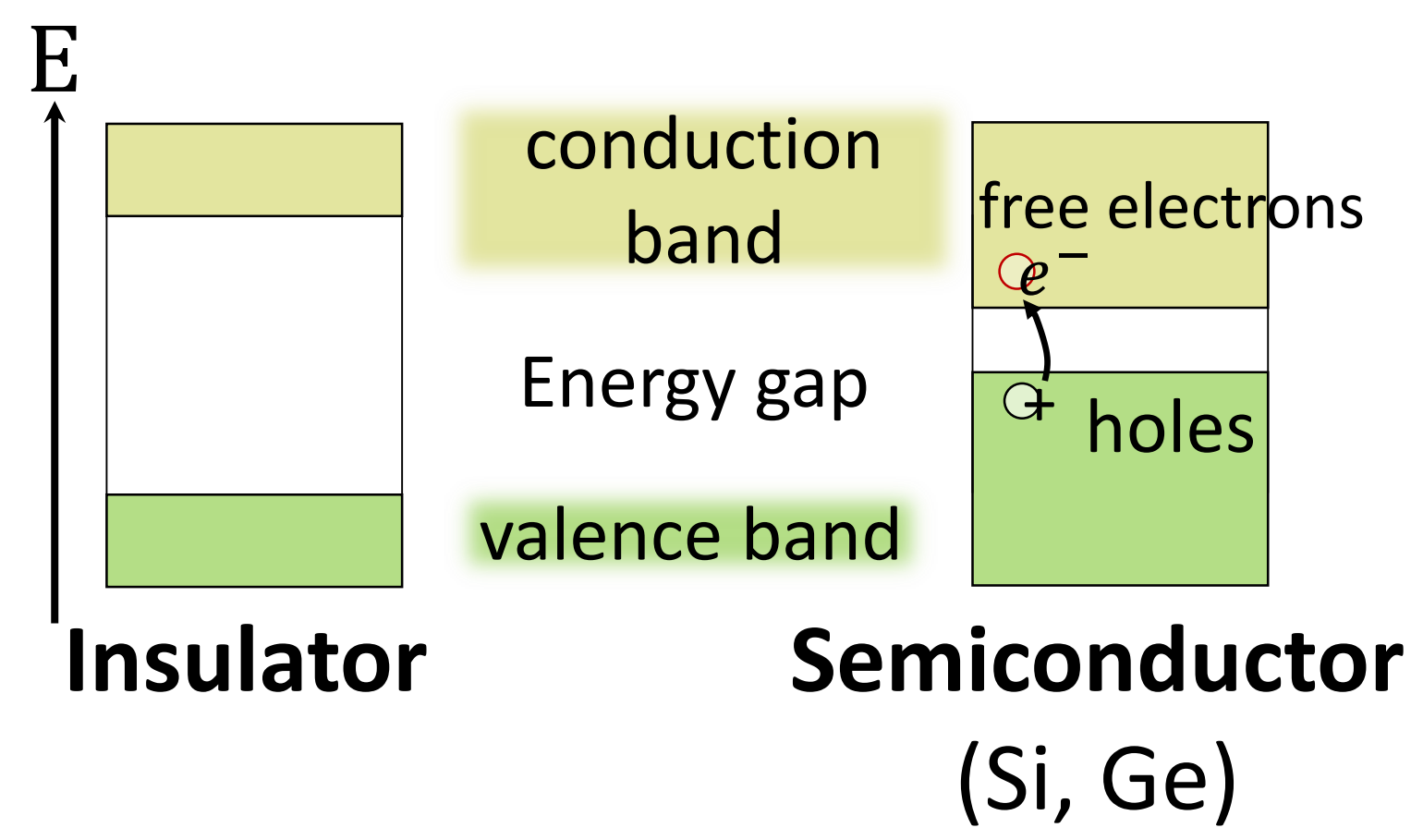
The ATLAS Inner Tracker (ITk) will be the new all-silicon Inner detector of the ATLAS experiment for the Phase-II upgrade of the LHC.

Cope with extreme radiation damage, with low material budget, high granularity, and tracking coverage up to $|\eta| = 4$.

The central region composed of 5 Pixel and 4 Strip layers up to 1 m radial distance. Forward region composed of disks up to $z = 3$ m.

Baseline Pixel detectors will be 3D sensors for inner most layer and planar sensors everywhere else. All hybrid detectors.

MALTA (silicon detector)



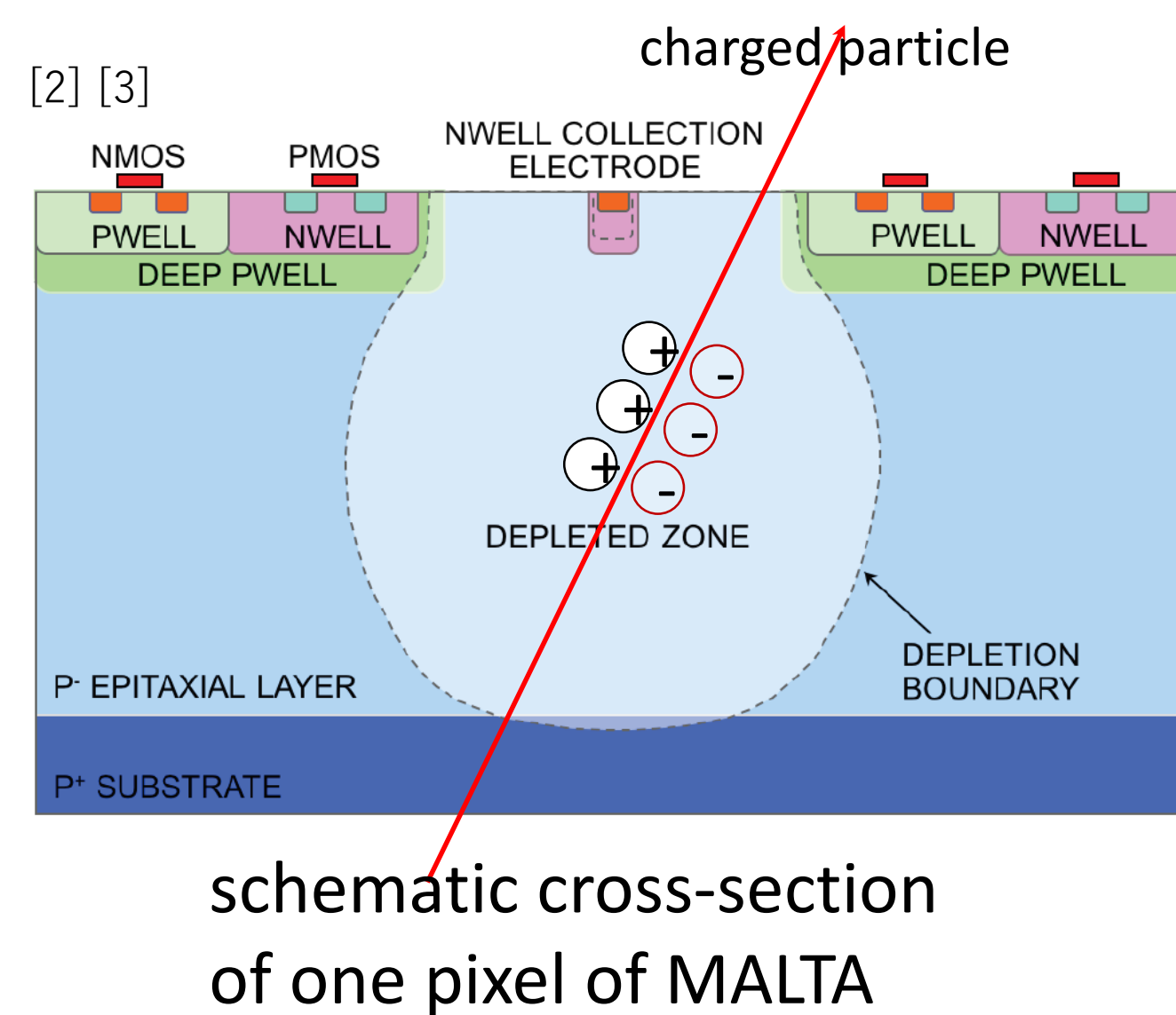
Silicon(semiconductor) has smaller energy gap than insulators, so it's electrons are excited with less energy.

Semiconductor is controlled by doped small amount of impurities.(p type and n type)
Basic silicon detectors are made by joining these two type materials together and applying a reverse bias.

MALTA is **monolithic Pixel detector** made in CMOS technology by TowerJazz using 180nm size transistors.

hybrid detector (conventional):
joining silicon pixel sensor and read-out chip after making each of them.

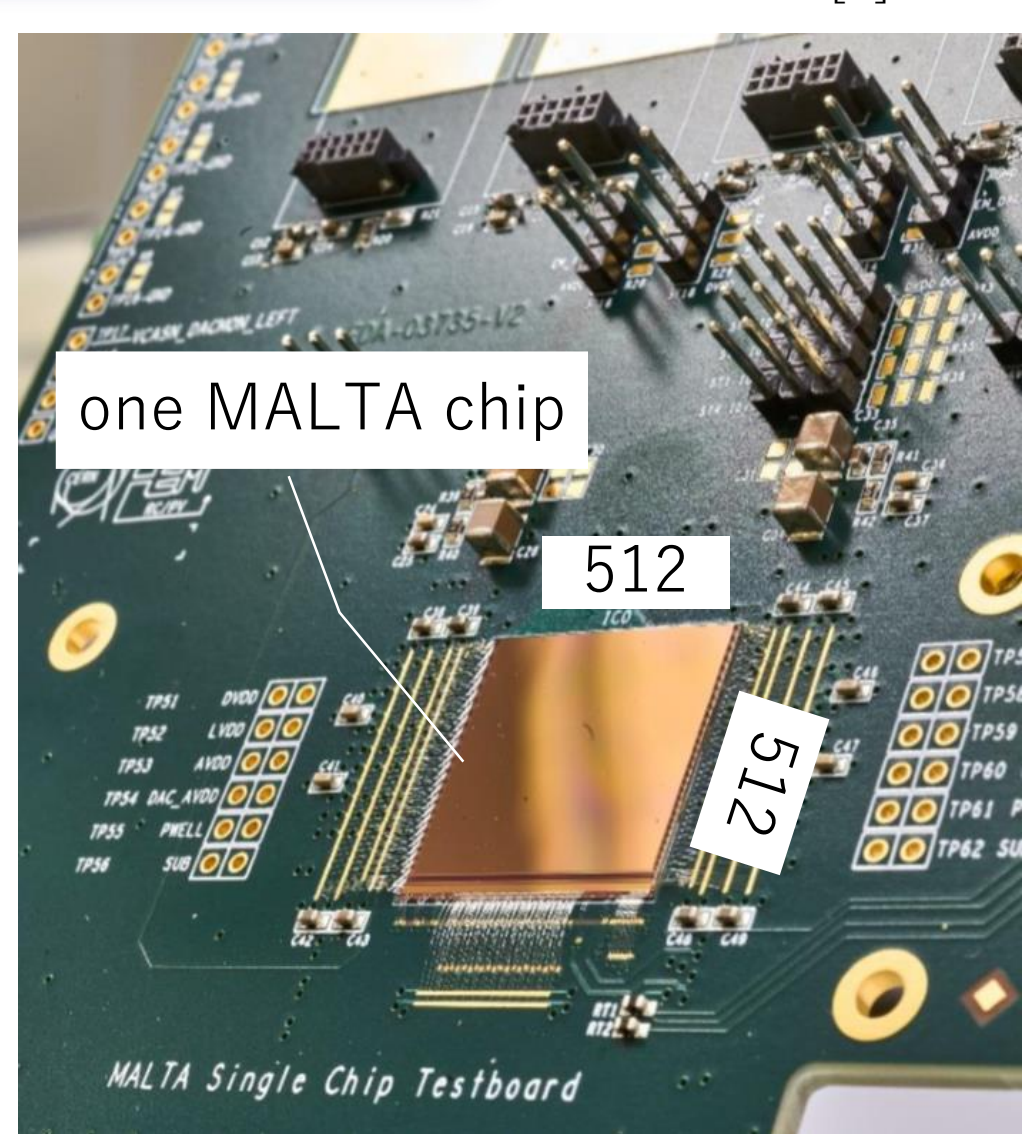
monolithic detector (R&D):
the readout circuitry is combined in one piece of silicon.



MALTA threshold scan

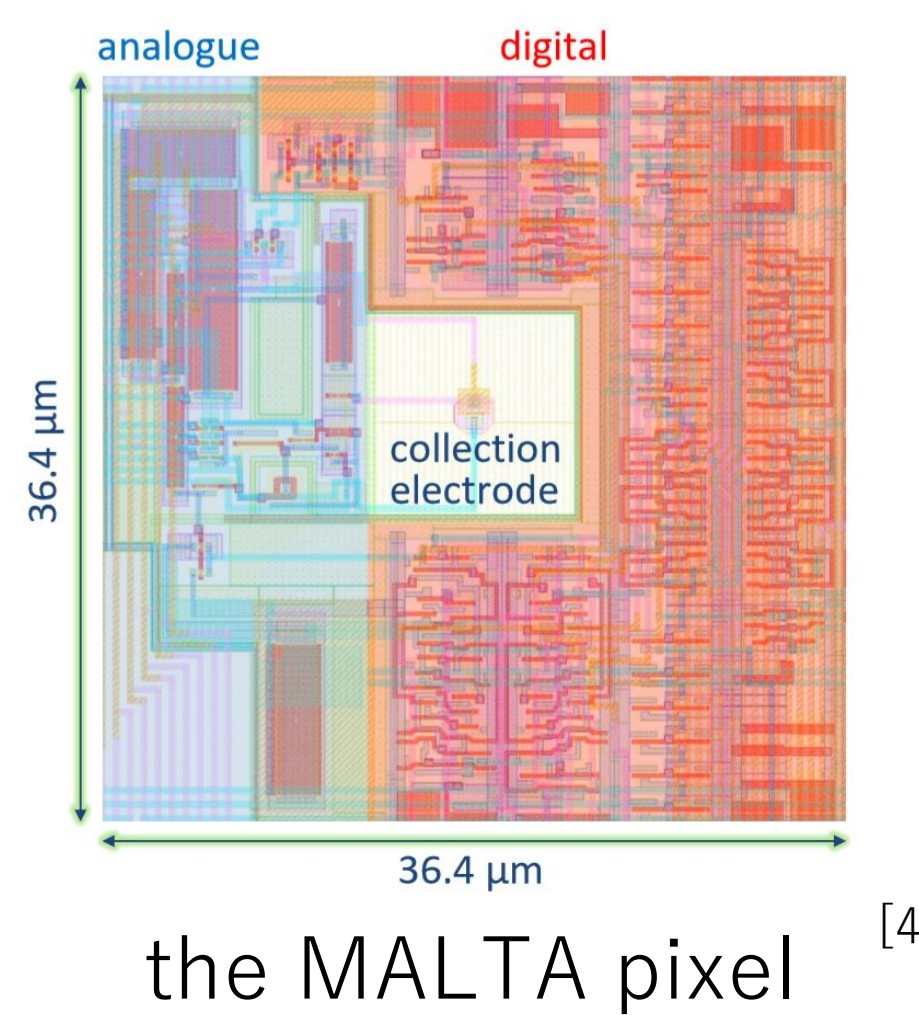
I. Introduction

MALTA

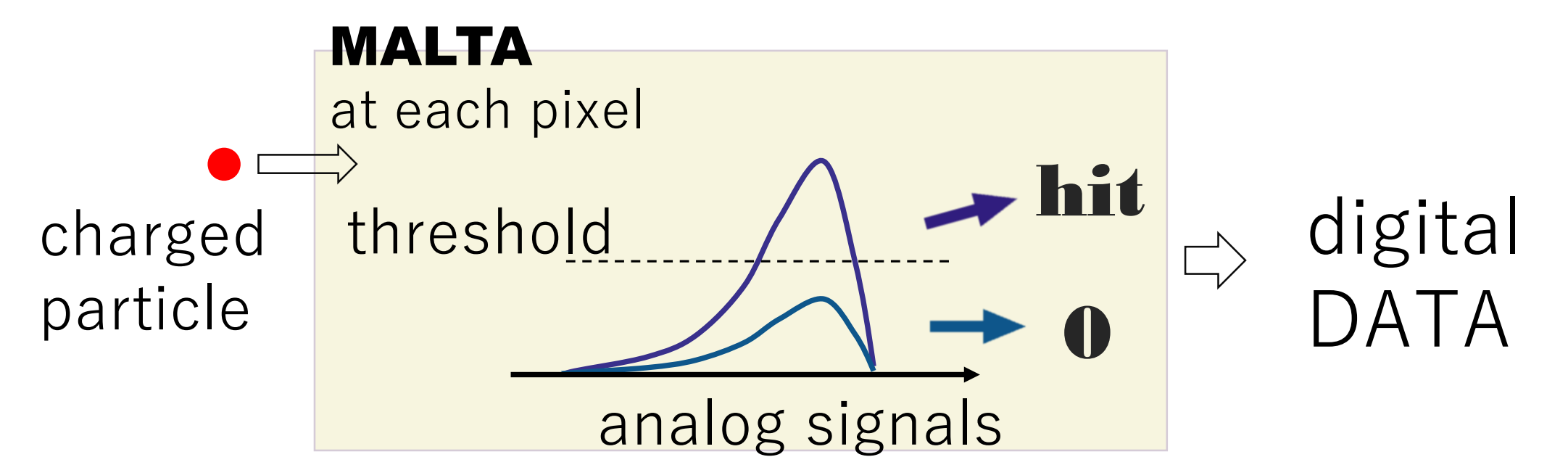


Threshold Scan :
To know what is the threshold of each pixel

One MALTA chip consists of 512×512 pixels with a pitch of $36.4 \mu\text{m}$.
Aim to be operational after $1 \times 10^{15} \text{ n}_{\text{eq}}/\text{cm}^2$



Threshold



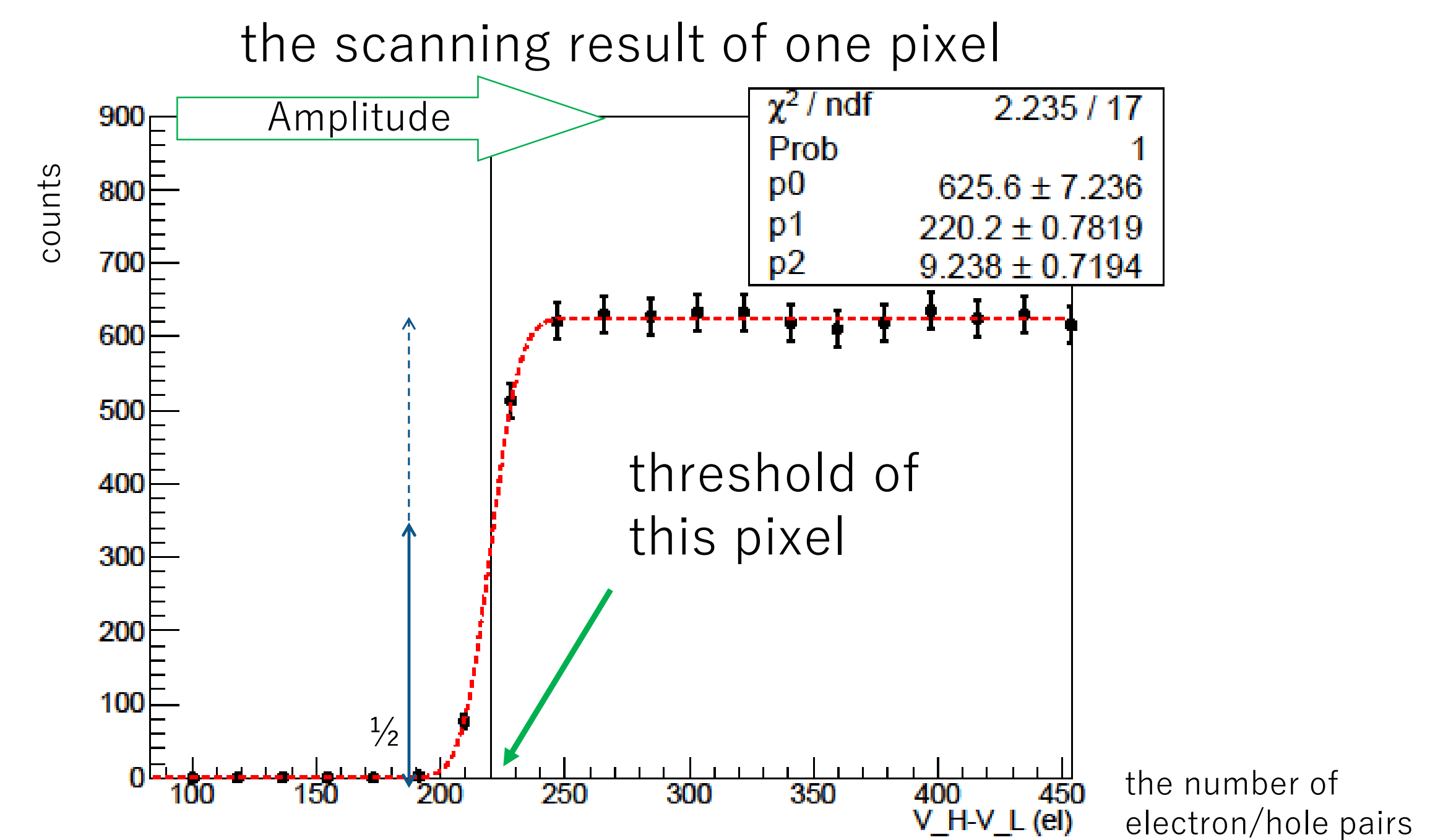
Threshold can be set by the software configuration.

II. Method

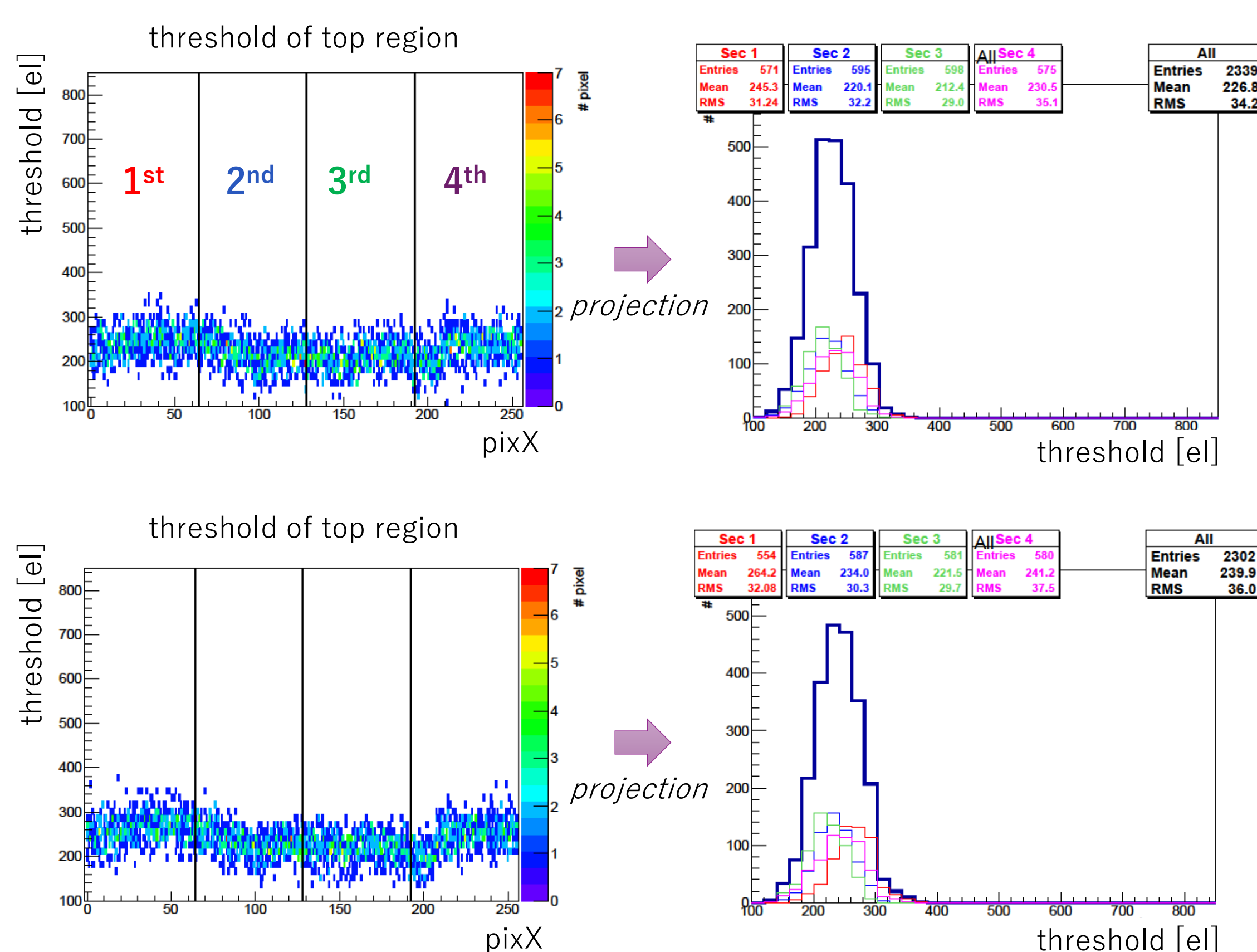
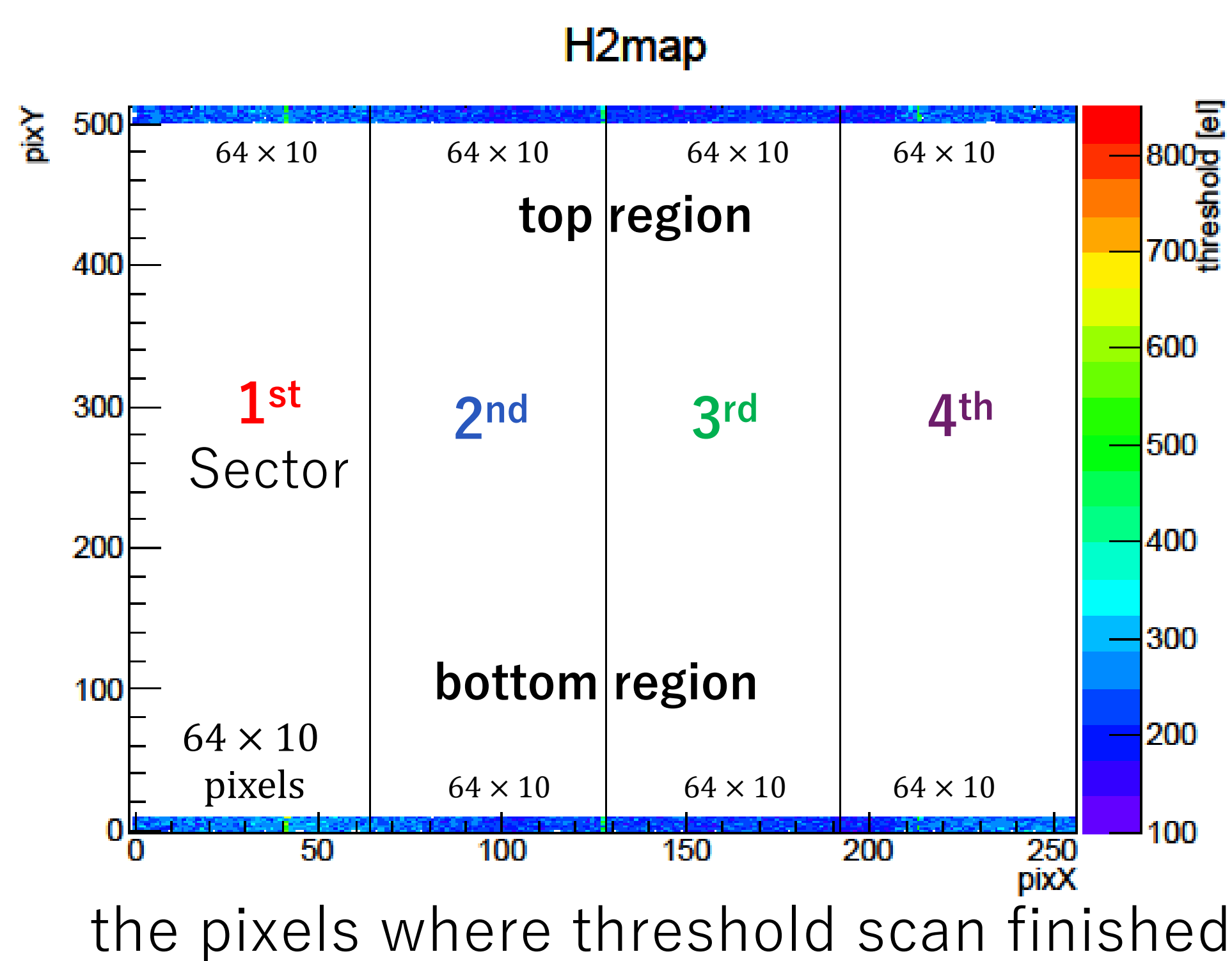
- Injected 500 pulses into the one pixel instead of charged particles, changing amplitude of the pulse.
- When amplitude is below to threshold there is no hits.
- As amplitude become higher, the number of hits increase.
- Fit error function with three parameters : pedestal, threshold and noise.

one Pixel Scan time
90 sec

→ Repeated this procedure for each pixels.



III. Current result & Analysis



- Current code optimizations achieve time reduction of factor 5 per scan.
- The threshold scans have been finished in the top and bottom region.
- There is no significant difference between thresholds of the two region.

IV. Discussion & Future outlook

- Continue to scan for the other regions or at different configurations.
- Characterize full set of MALTA pixel detector chips available, and discuss about more details of the performance of MALTA.