

# Simulation of the response of the ALICE silicon pixel detector

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- Description of the simulation model.
- Predictions:
  - row and column cluster lengths;
  - x and z resolutions;
- Comparison with experimental data.
- Conclusions and Outlooks.

# Description of the model

The model provides an algorithm to determine the fired pixels (**digits**) starting from the impact coordinates of the track on the SPD (**hits**).

The following effects are taken into account:

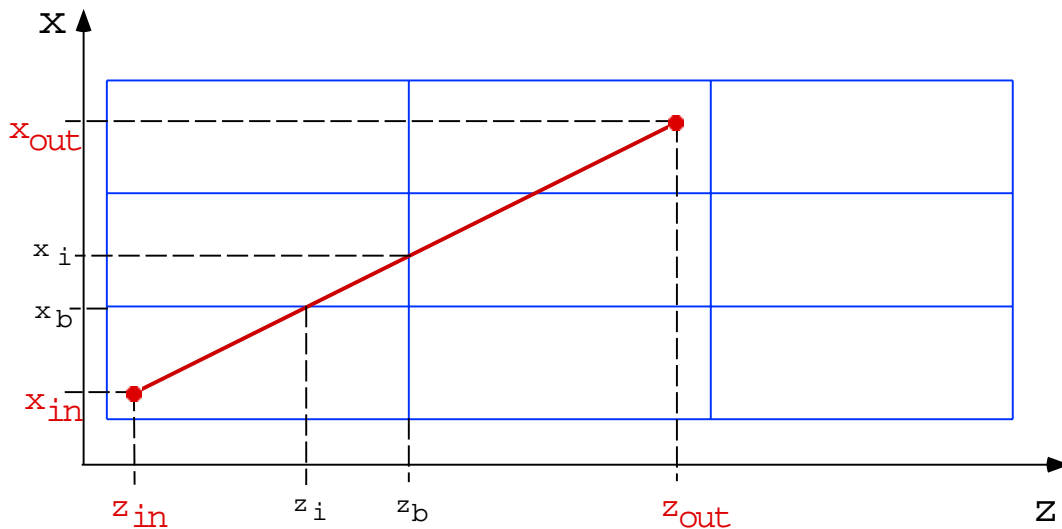
- Geometrical charge sharing;
- Electronic noise and threshold non-uniformity;
- Coupling effects;

# Geometrical charge sharing

**Real effects:** 1) the energy lost by the particle is shared among all the crossed cells  $\Rightarrow$  more than one pixel could be fired;  
2) when a particle passes through the dead zone between two cells, the generated charge carriers are shared between them.

**Simulation:** The pixel cells are contiguous and the energy lost in each cell ( $E_l$ ) is proportional to the track length.

A pixel is fired if  $E_l > E_{th}$ .



**Parameter:**  $E_{th}$  = threshold to the energy lost in a single cell.

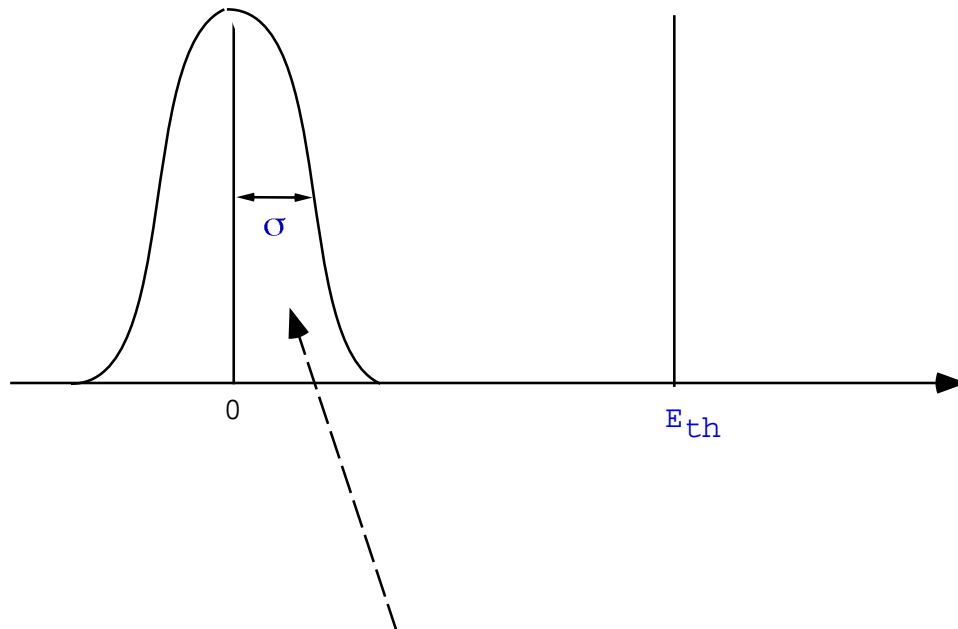
# Electronic noise and threshold non-uniformity

**Real effects:** 1) fluctuations of the electronic noise in each pixel in time domain;  
2) spread of the discriminator thresholds in the different cells of the read-out chip.

**Simulation:** pedestals fluctuate from event to event (time) and from pixel to pixel (space)

$$E_p \sim N(0, 1)\sigma$$

A pixel is fired if  $E_l + E_p > E_{th}$ .

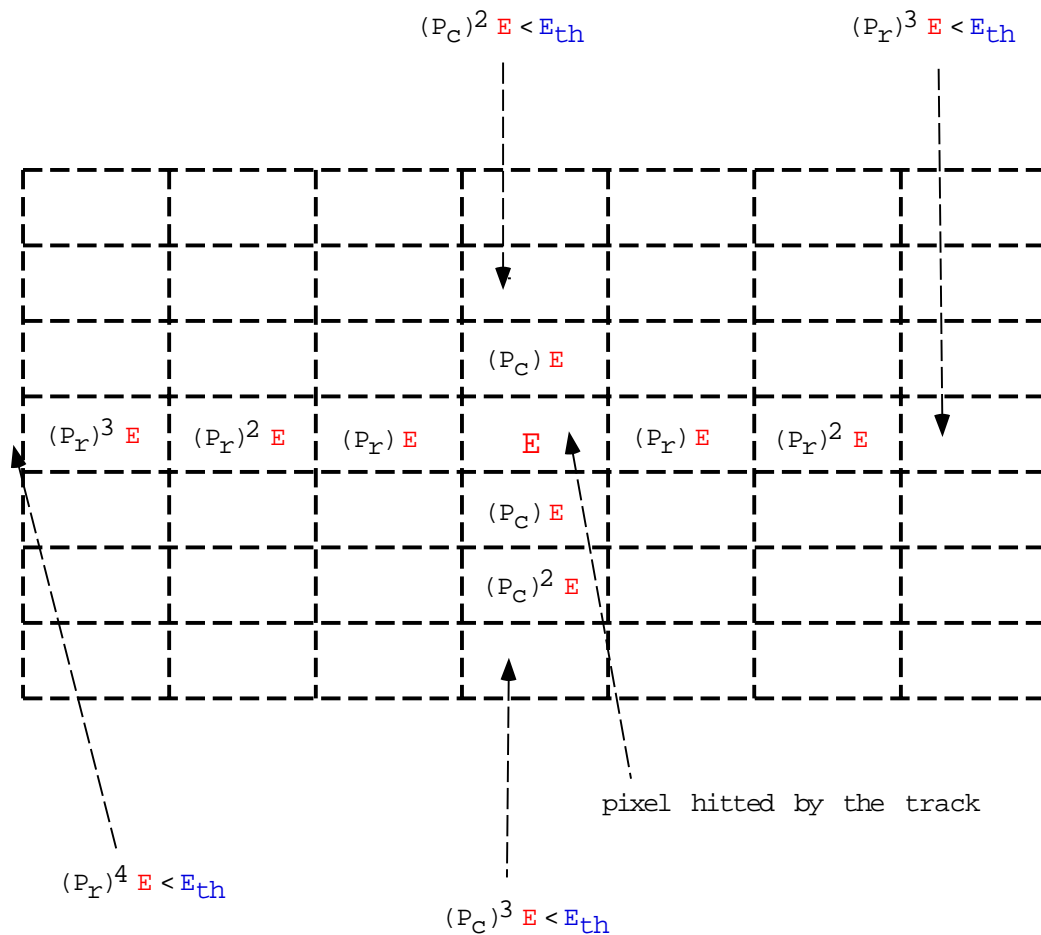


**Parameter:**  $\sigma = \sqrt{\sigma_{noise}^2 + \sigma_{thresh.}^2}$ .

# Coupling effects

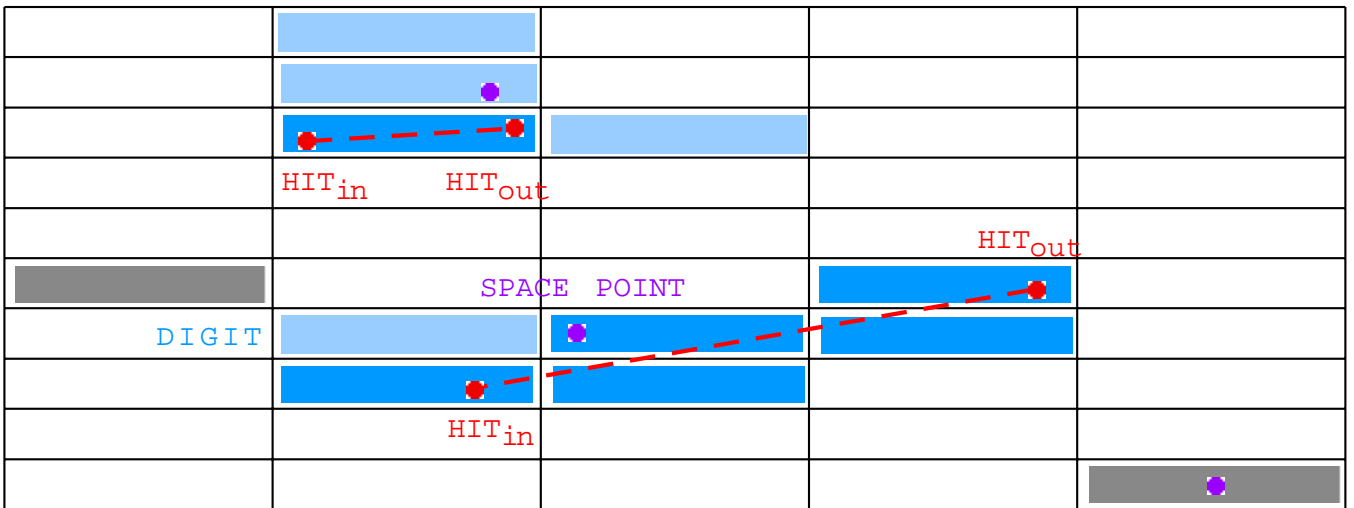
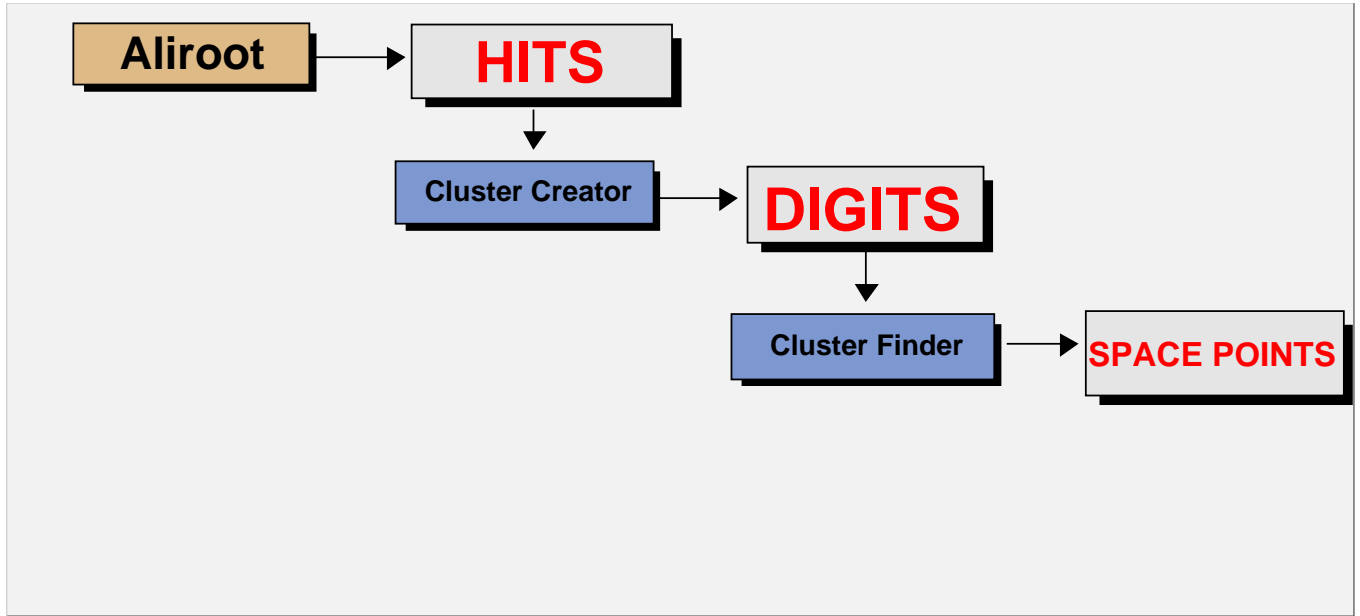
**Real effect:** 1) capacitive coupling between pixels;  
2) cross-talk between electronic read-out channels.

**Simulation:** a fraction of the energy lost is assigned to the next cells in the same row and in the same column.



**Parameters:**  $P_r$  coupling in row direction  
 $P_c$  coupling in column direction.

# Implementation in the ALICE off-line code



# Detector geometry

