Working with Pixels

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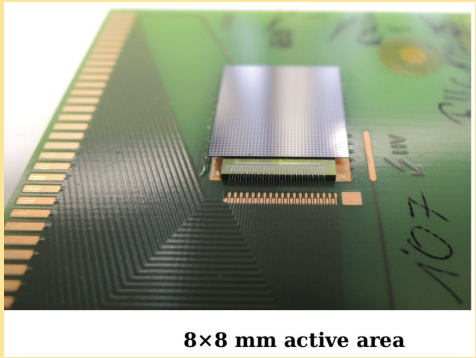
Pixels and silicon

The third most abundant element on Earth!



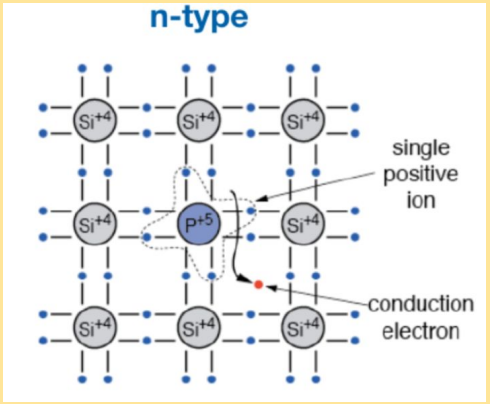
8×8 mm active area

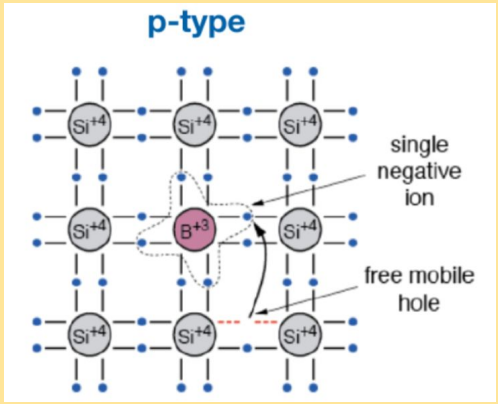
With them you can know **where** the particles went through.

Pixels are made by **silicon**

- Semiconductor
- Bounds among silicon atoms can break and an electron-hole pair is created.

The different kinds of Silicon





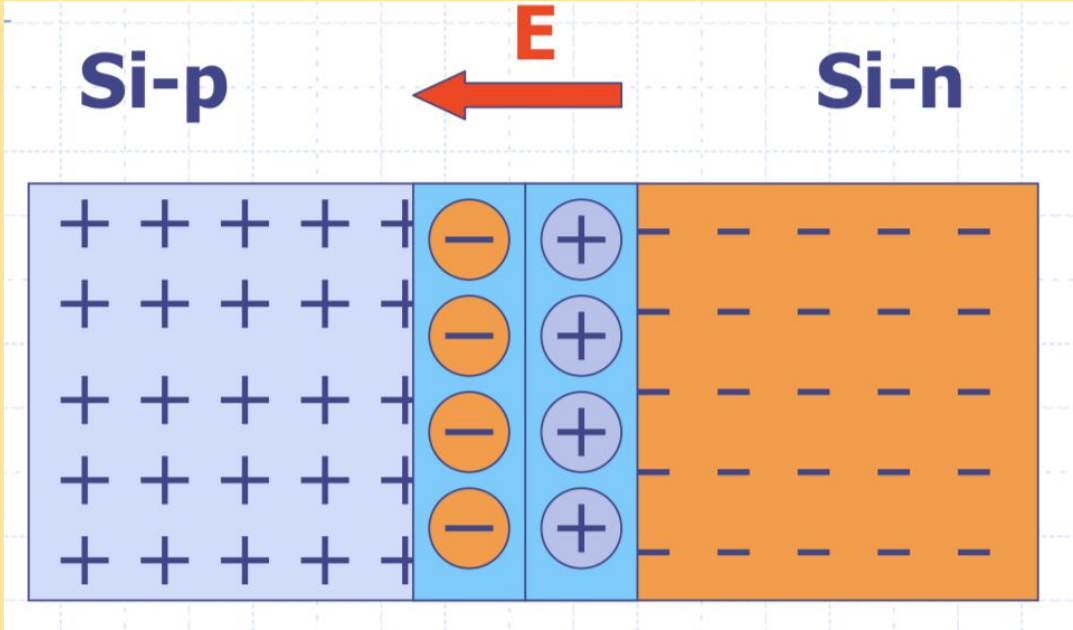
N-type semiconductor

- donor of electron
- free carrier **-** (n)
- ion **+**

P-type semiconductor

- acceptor of electron
- free carrier **+** (p)
- ion **-**

The P-N junction



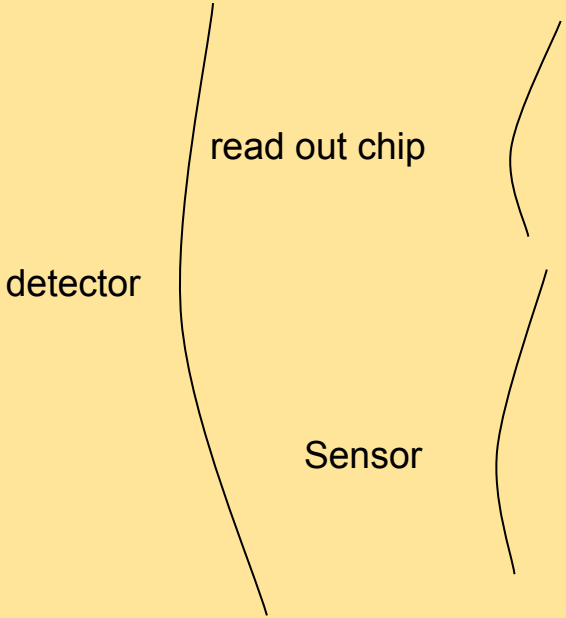
If we put together **Si-p** and **Si-n**, the free charges mix between them.

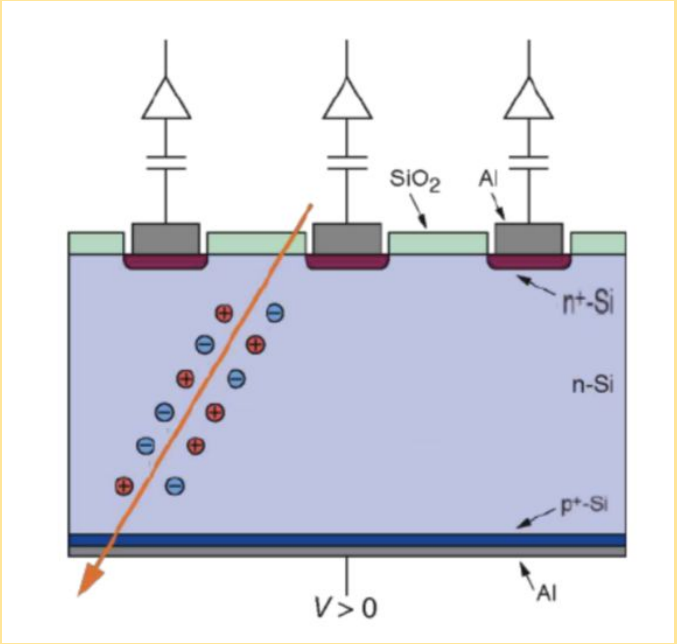
Depletion zone where we can track particles because there are only ions.

What is a Pixel detector?

The detector is used to collect data about charged particles.

1. A particle goes through the Silicon
2. Ionization
3. Electrons and holes drift and generate an electric signal
4. Data are collected by the read out chip



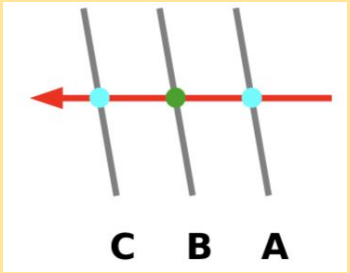


Test Beam

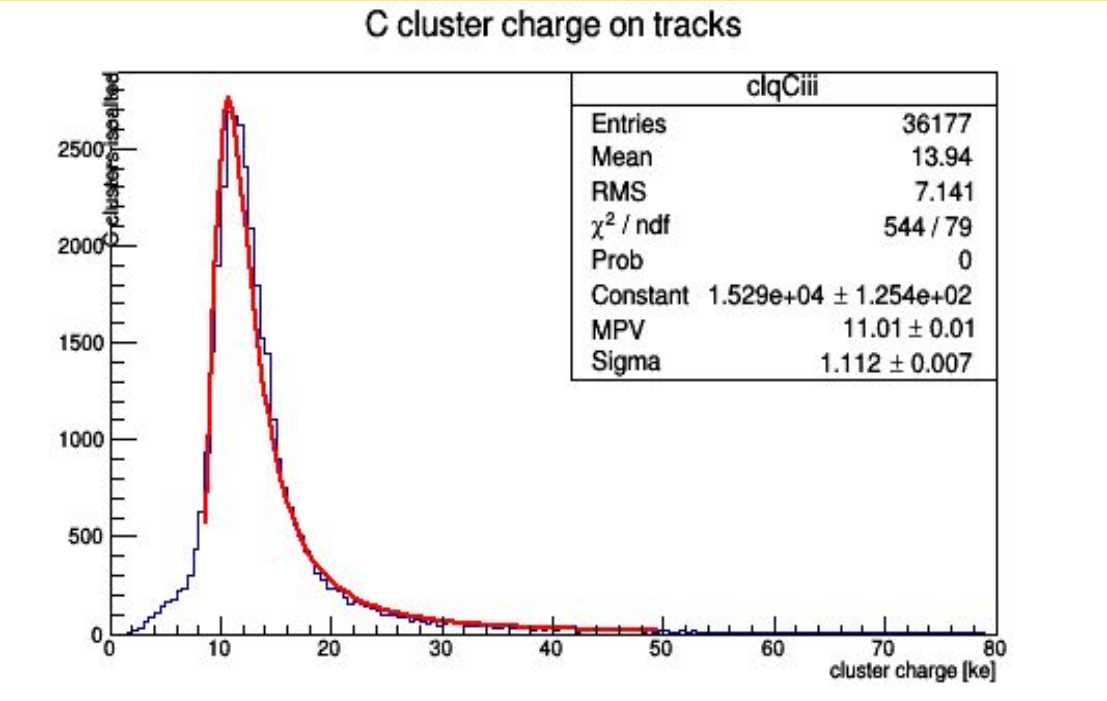
In the Test Beam the electrons that come from the particles accelerator collide with pixels.

Dreimaster

Aligning the three sensors we can create the track.



Collected charge



Landau fit

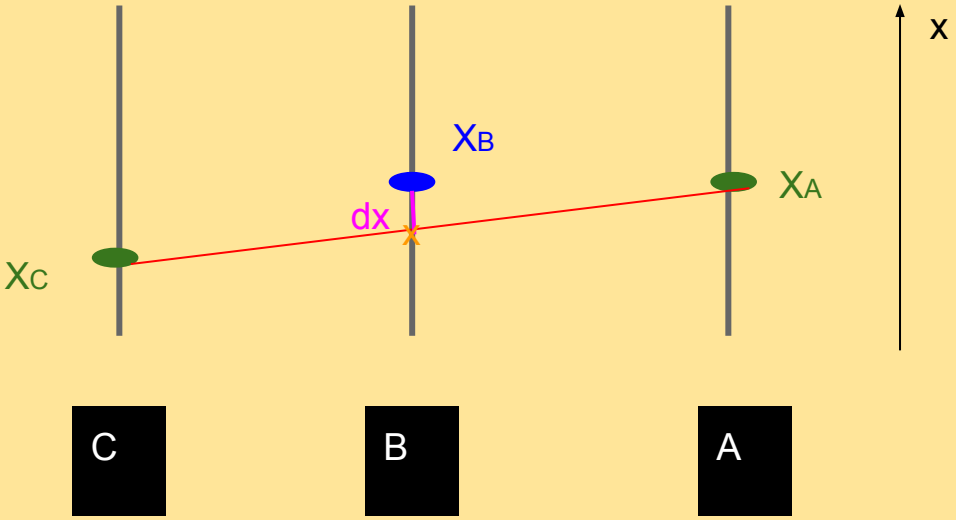
↓

Check MPV (Most probable value)

↓

Energy Value that a charged particle releases when it passes through Silicon.

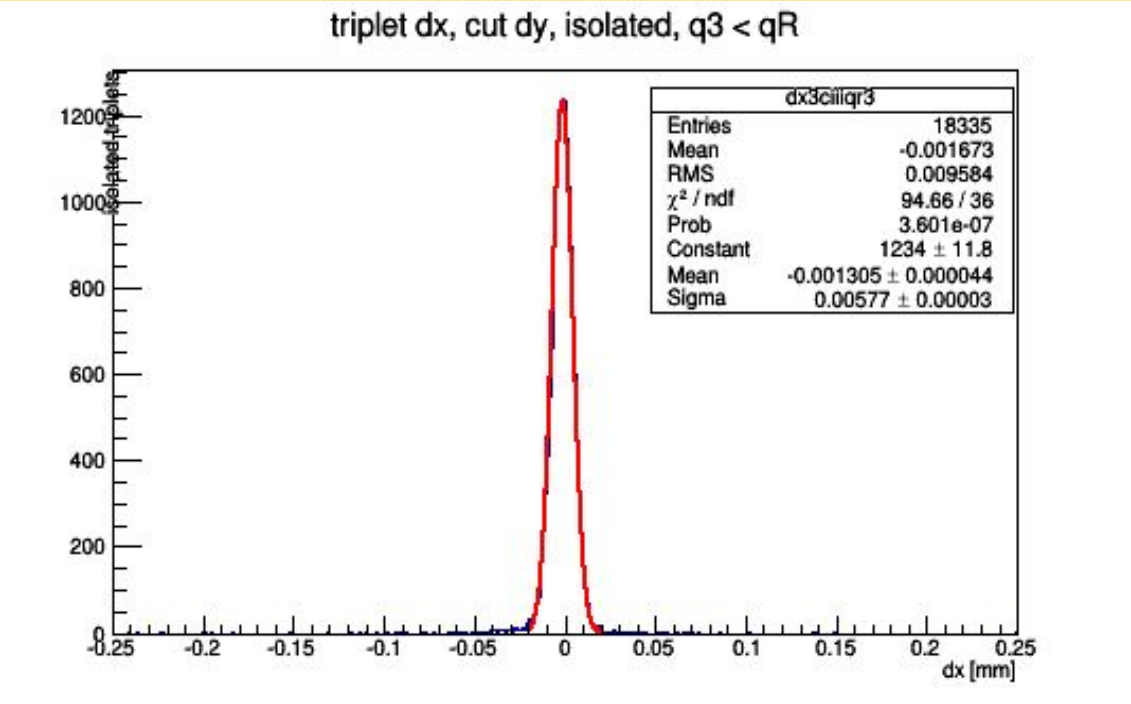
Resolution Data



dx = residuals

Through many measurements we obtain the **residuals' distribution.**

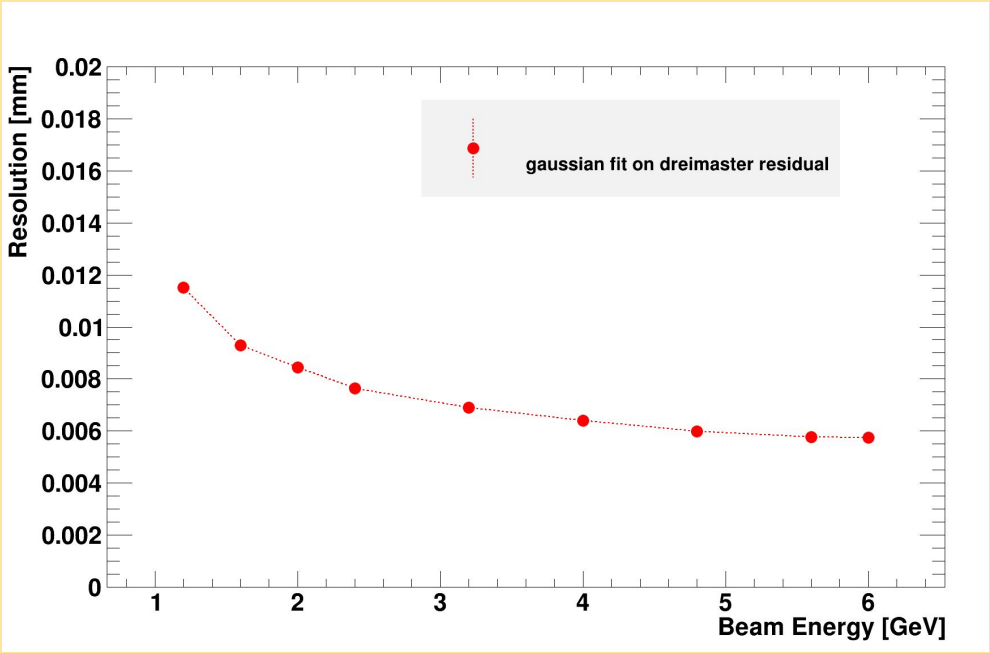
Residual distribution



Gaussian fit

Resolution=***sigma***

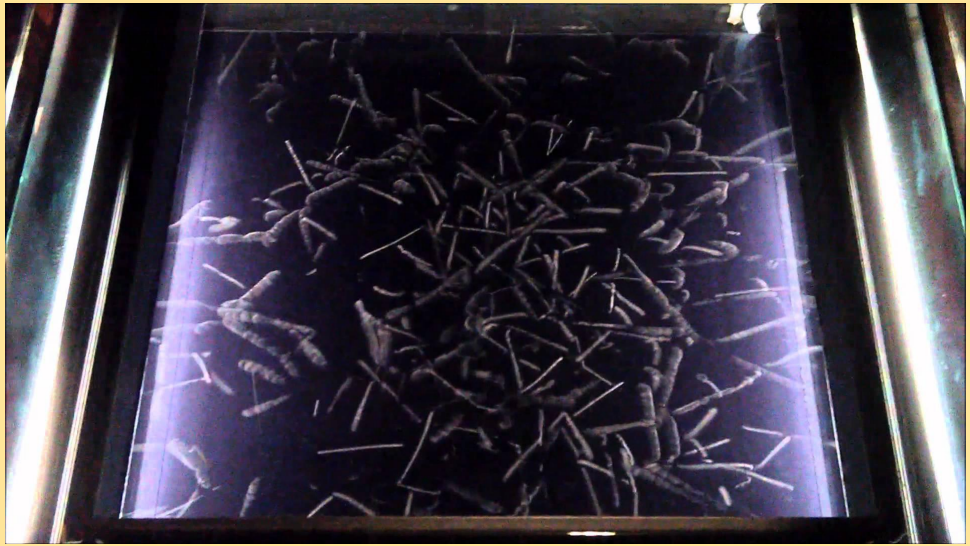
How does the resolution change?



High energy → better resolution (smaller value)

Low energy → worst resolution (bigger value)

Cloud Chamber



This is another instrument to see particles and thanks to their **shape of track** we can recognise the different kind of particles.

Thanks for your attention