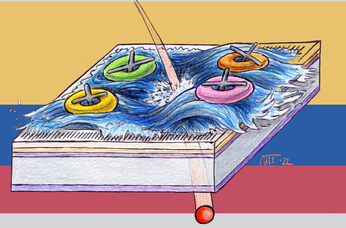
Silicon sensors with resistive read-out: ML and analytics techniques for ultimate spatial resolution



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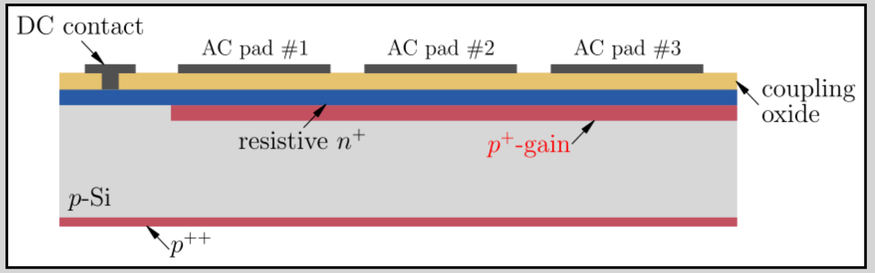
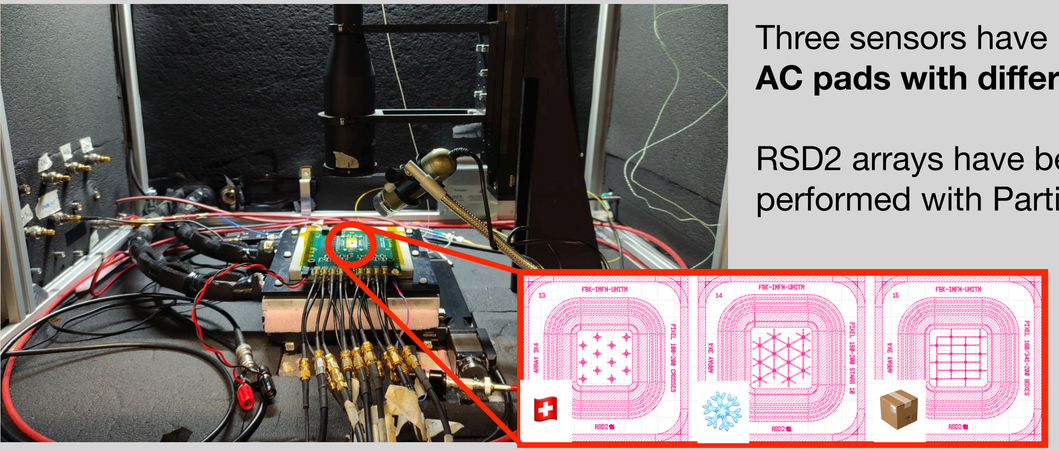
Resistive AC-coupled Silicon Detectors (RSD) are a new generation of n-in-p silicon sensors with 100% fill-factor designed for high-precision 4D tracking in experiments at future colliders

Key feature: **introduction of resistive read-out in silicon detectors**

→ **signal sharing** allowing **excellent spatial resolution**





Three sensors have been selected from the **second RSD production**: 700x700 µm active area, 200 µm pitch and 3x4 **AC pads with different layouts** (Swiss crosses, flakes and boxes)

RSD2 arrays have been tested in the **Laboratory for Innovative Silicon Sensors** in **Torino** with precise **laser scans** performed with Particulars **Transient Current Technique setup** for spatial resolution evaluation

Signal properties are used for **position reconstruction** of laser shots

→ **Machine Learning** is ideal for data analysis, with signal properties used as input features and predicted x-y coordinates as outputs

200-µm pitch RSDs can reach a total spatial resolution $\sigma_{tot} = \sqrt{\sigma^2_{RSD,x} + \sigma^2_{RSD,y}}$ **~ 8 µm**

→ **Much smaller than corresponding binary readout** $pitch/\sqrt{12}$ **~ 58 µm**