

# The status of SiPM developed by IHEP

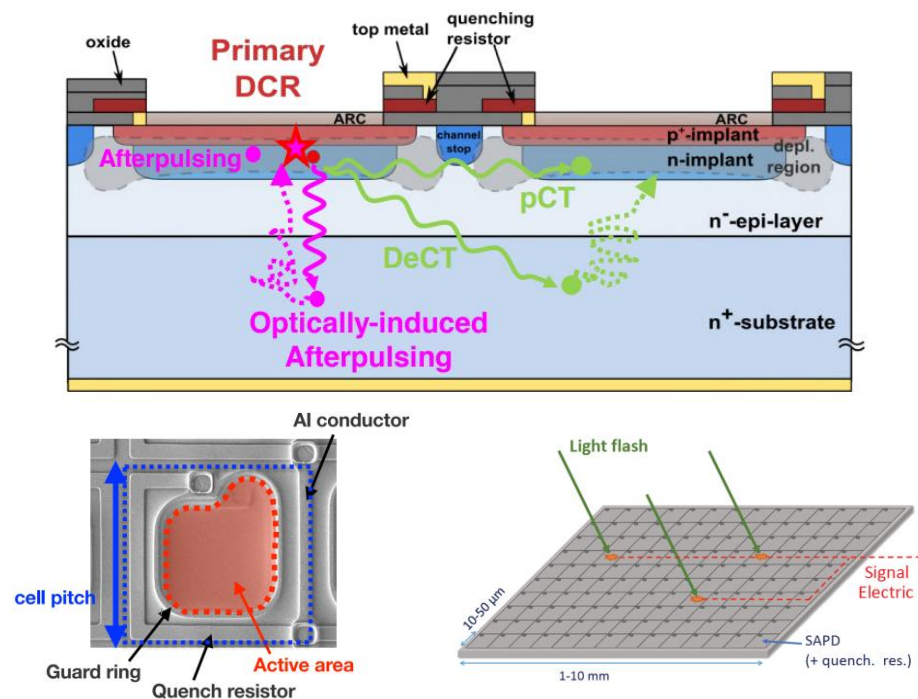
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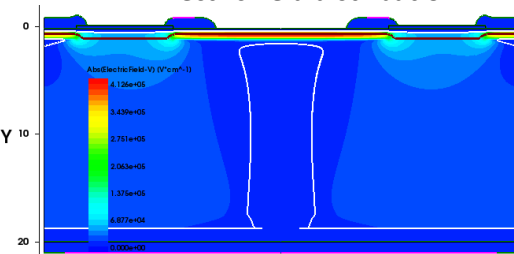
**Silicon Photomultipliers (SiPM)** has advantages such as low operating voltage, high gain, high photon detection efficiency, and resistance to magnetic field interference, making it a high-performance device for photon counting. SiPM is also a key component in major scientific projects such as CEPC, LACT, and HERD. Self-developed SiPM can reduce the construction cost of the detectors, conduct personalized customization, and will have high yield, high consistency, and sufficient production capacity. Preliminary structural and technological design of radiation resistant SiPM based on the existing domestic radiation resistant LGAD design. At present, preliminary performance testing has been completed for SiPM sample produced along with radiation resistant LGAD, and its structural design and some technologies have been verified.

## Introduction to SiPM Structure

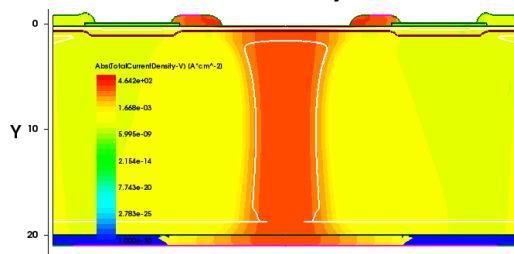


## IHEP SiPM v1 design

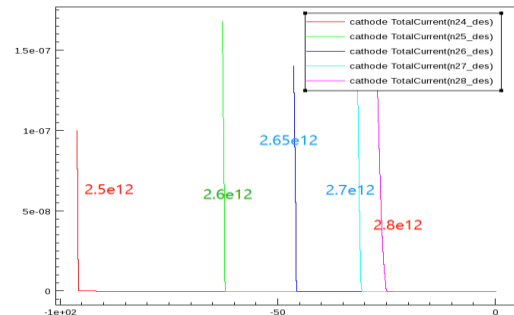
Electric field distribution



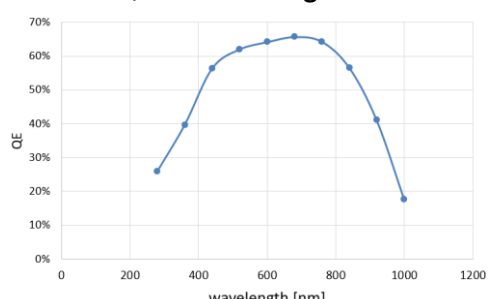
Total current density distribution



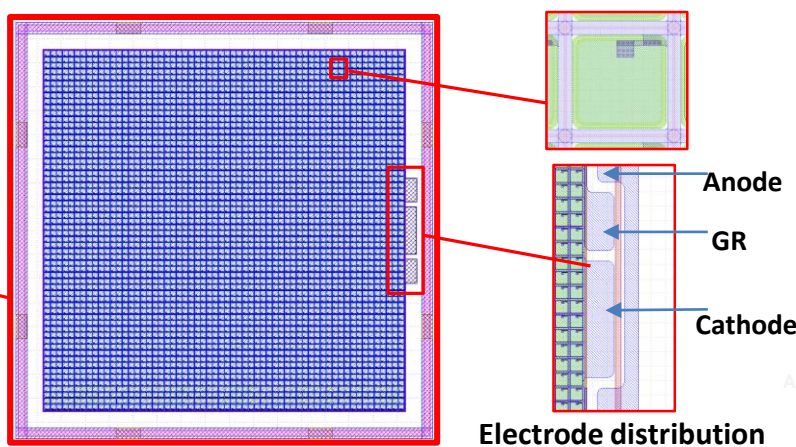
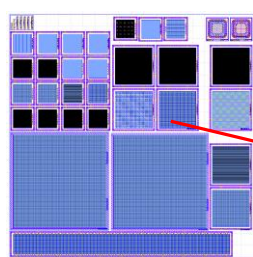
I-V



QE vs. Wavelength



## Mask design



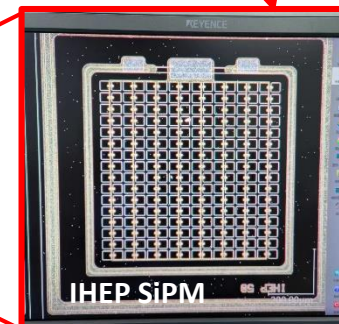
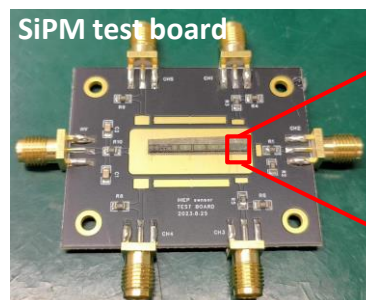
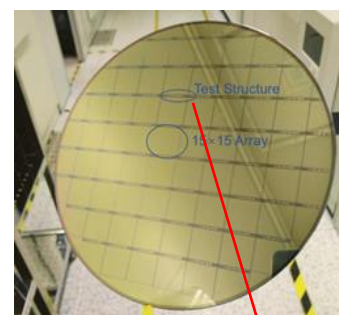
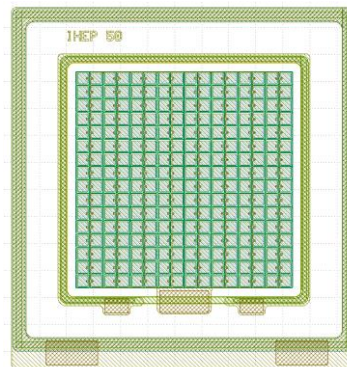
### SiPM size:

- 7.6mm×7.6mm
- 3.0mm×3.0mm
- 1.5mm×1.5mm
- 152 x 152 pixels
- Pixel size:
- 100μm、 50μm、
- 20μm、 10μm

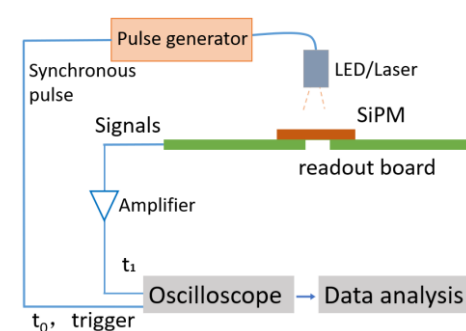
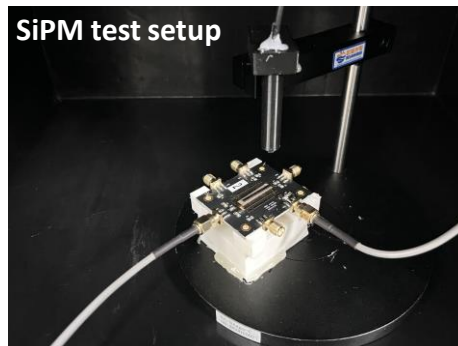
### Formal tape-out plan:

- **Submit design layout at the end of October**
- **Complete the first version of tape-out by the end of the year**
- **January to February 2024: Testing**
- **March to April 2024: Optimize the design and submit the second version of the tape-out**

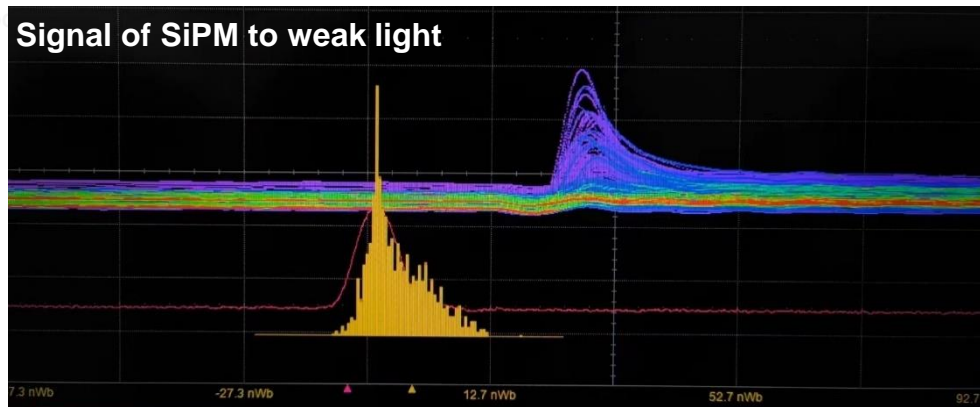
## SiPM sample produced along with LGAD pre-production (IHEP SiPM v0)



## SiPM test setup



## Signal of SiPM to weak light



IHEP's self-developed radiation resistant SiPM based on LGAD's existing excellent technologies and structural design will be used for collider experiments and space experiments. At present, we have produced SiPM samples, and after preliminary testing, the energy resolution and leakage current need to be optimized. The official wafer layout has been designed and SiPM wafers are planned to be completed by the end of this year for further testing and optimization to develop SiPM with radiation resistance and large dynamic range.

