

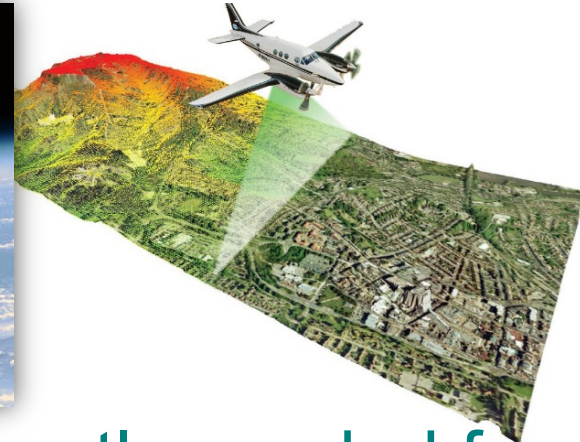
# SiPM Characterization

## Lab session at Joinbon

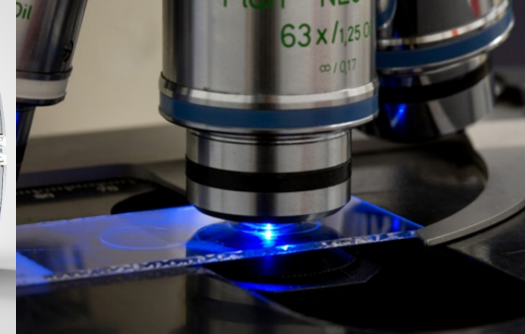
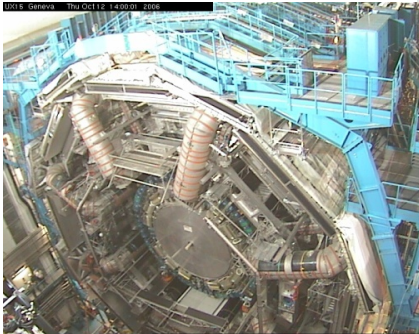
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Monday, May 13, 2019

# Introduction

- ✓ Radiation detection
- ✓ 3D Ranging & Sensing
- ✓ Biophotonics & Science
- ✓ High energy Physics
- ✓ Medical Imaging



Super unique device are urgently needed for  
**ultra low flux photon** detection



Semiconductor micro-cells structure operated in avalanche breakdown mode with quenching mechanism. Excellent features make it as the best candidate for ultra low flux photon detection

## High gain

- Internal gain up to  $10^6$  for small signal

## High sensitivity

- Response to single photon

## Fast response

- Rising edge less than 1ns

## High photon detection efficiency

- More than 40% at peak

## Low operation voltage

- Less than 50V, no need thousands voltages supply like PMT

## Compatible with magnetic field

- Working in magnetic field strength up to 7T

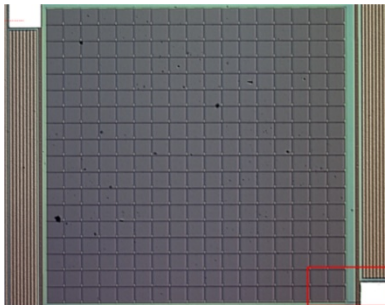
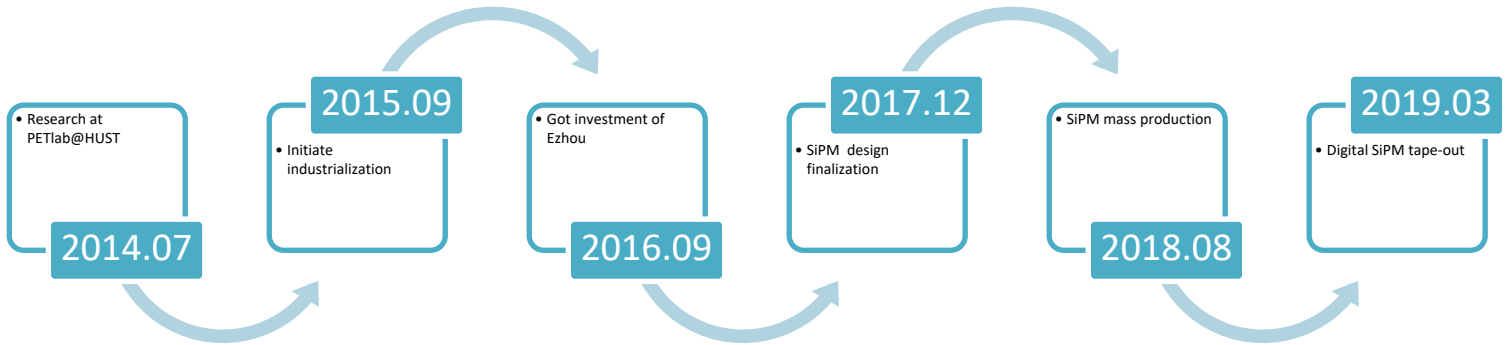
## Compact&Robust

- Suitable for detector array, stable with ambient conditions

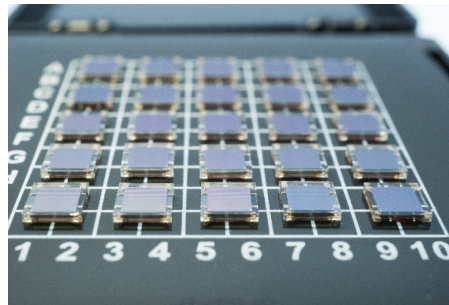
# About Joinbon



Focus on the innovative technologies in the field of ultra low flux photon detection



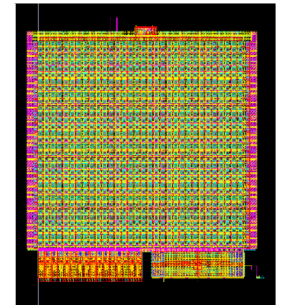
SiPM prototype



Commercial SiPM product



Large area TSV-SiPM

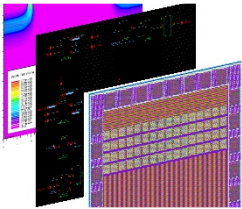


Digital SiPM imager

Continue to explore the leading edge of research and industry

Complete platforms from chip design to application module evaluation

## Design&simulation



- Process&device simulation
- Analog/Digital mixed signal IC design
- Layout&verification

## Electric testing



- Wafer level parameter probe
- Device Breakdown characteristics
- Small signal AC measurement

## Photoelectric testing



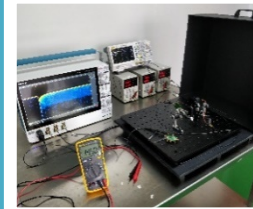
- Single photon signal
- TOF performance
- Noise evaluation
- PDE measurement

## Mass testing&selection



- Statistics analysis
- Quality Inspection
- Automatic selection&packaging

## Application module R&D



- Evaluation board development
- Detector module development
- Typical application research

Device Layout

Wafer

Prototype

Chip product

Module

Students will have an overview of IC design workflow and go deep into physics of SiPM and technical characterization method

## Static characterization of SiPM on wafer

Semiconductor physics of SiPM

Technical characterization

Depletion

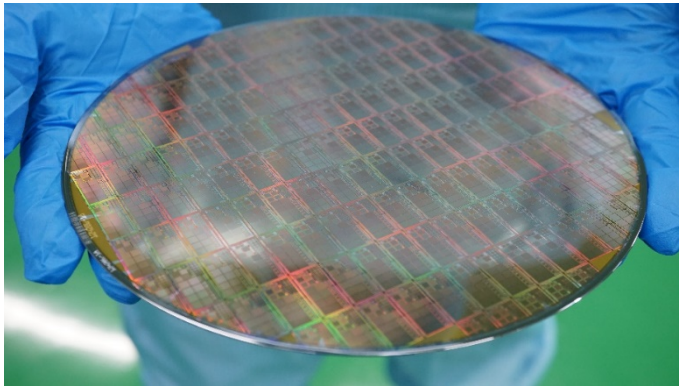
Dark current

Impact  
ionization

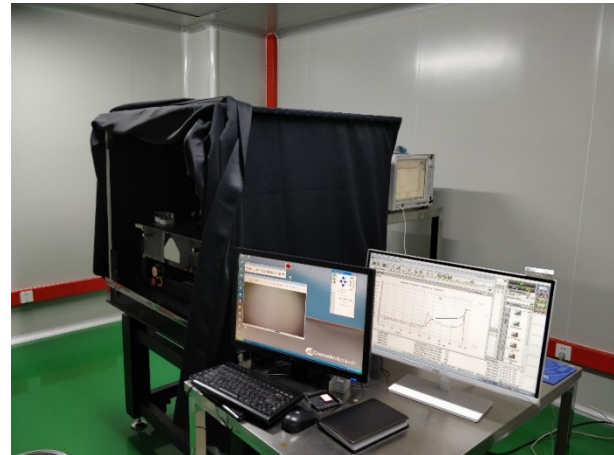
Avalanche  
breakdown

CV curve

IV curve



Wafer of SiPM production



Electric testing platform



## Evaluation of packaged chip

Signal characteristics

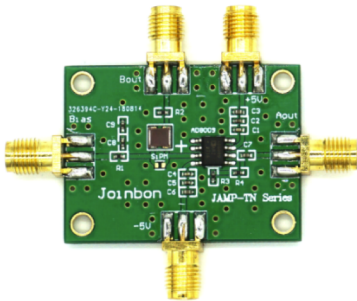
Noise observation

High sensitivity

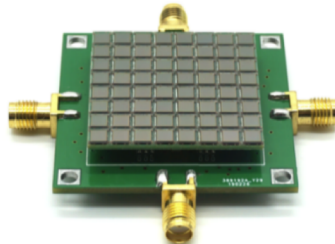
Fast response&recovery

Dark count

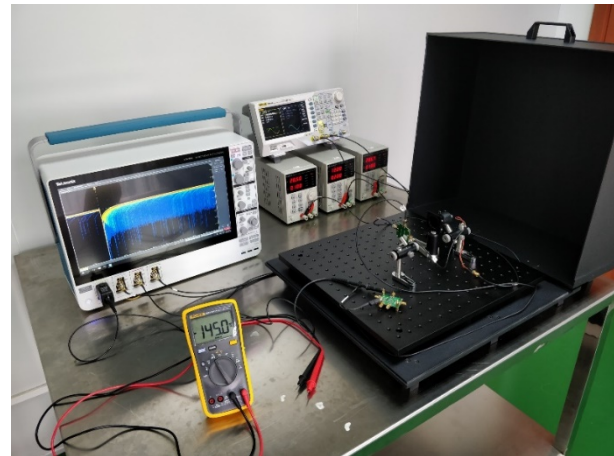
Afterpulse



Evaluation board



Engineering board of array

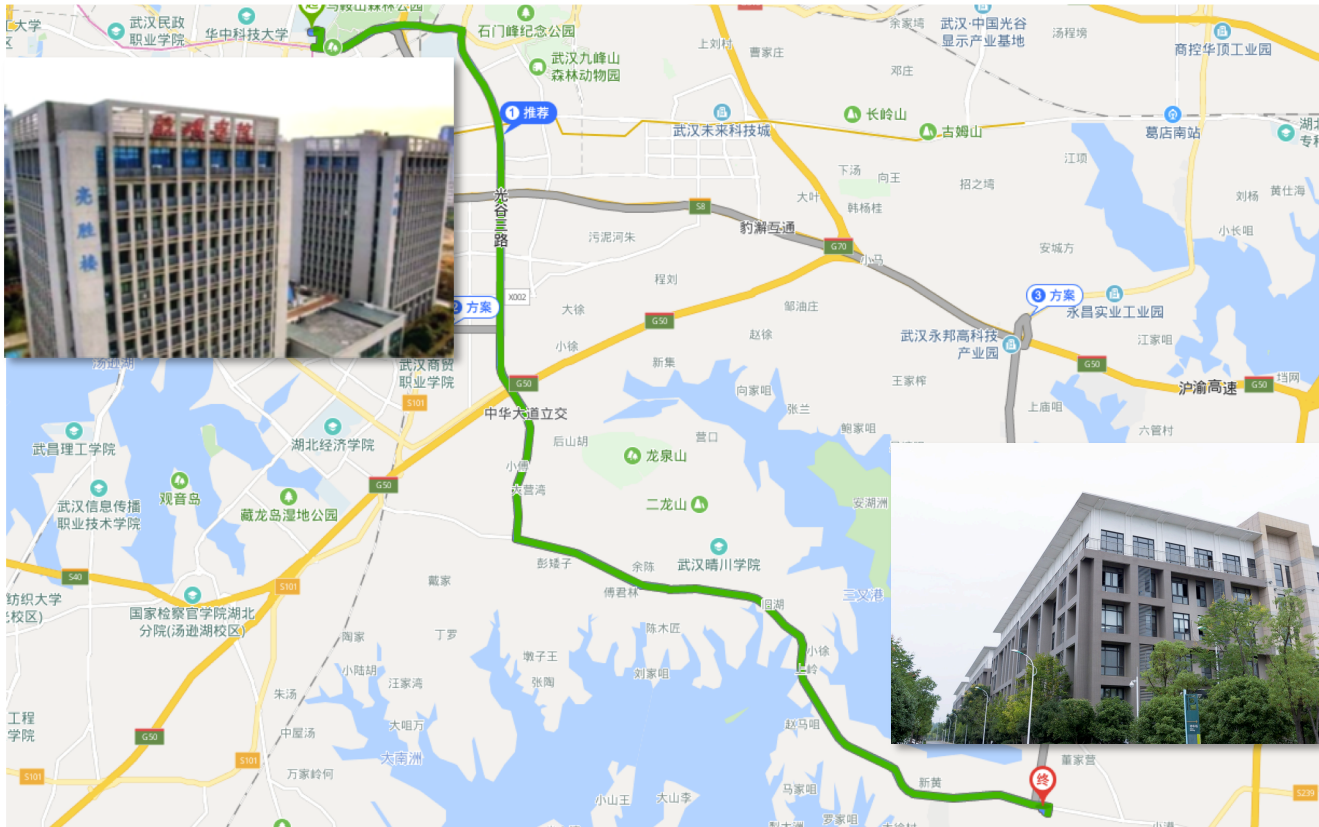


Application module R&D platform

# Transportation to Joinbon



35 km from HUST, 50 minutes for Driving





**THANK YOU!**