

# 3-in-1 Opto-electronic Measurement System

## The Challenge

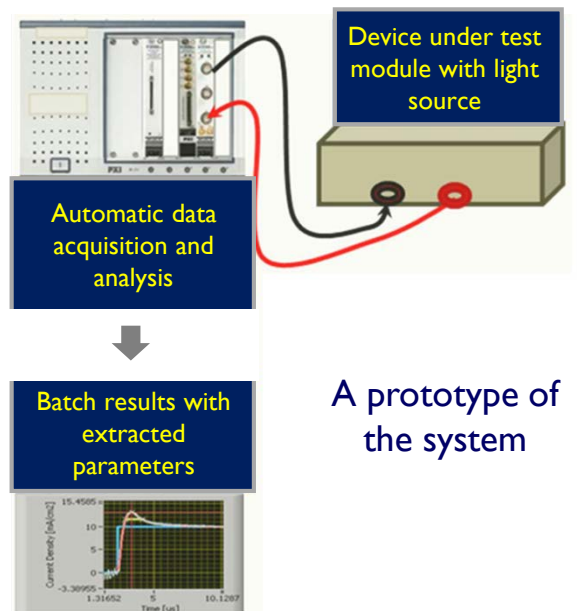
- To eliminate the need for
  - multiple electronic components and a laser system which require a dedicated optics lab with laser safety features
  - licensed laser holders to operate laser equipment
  - manual experiments and analysis involving huge amount of data and manual set-ups of the measurement parameters
  - lengthy iterative measurements to assess the device quality

## Key Features of IMRE Solution

- Portable and user-friendly set-up no larger than a desktop computer
- Automated data acquisition system with built-in data analysis software and the ability to integrate multiple measurements
- Easy to operate; no need for a licensed laser holder as laser has been replaced by pulsed LED

## Potential Applications

- In device reliability studies to develop semiconductor devices and processes
- In new materials design and synthesis to identify and modify materials for optimum performance
- In materials quality control to verify the quality of the materials synthesised by different manufacturers



## Collaboration Opportunities

- Partner interested parties such as instrumentation companies to incorporate AI features
- Develop testing set-ups for companies who wish to assess materials, structures or devices or perform quality control and device failure analysis
- Licensing of built-in data analysis software



For more information, please contact:  
industry@imre.a-star.edu.sg



IMRE website: <https://www.a-star.edu.sg/imre/>  
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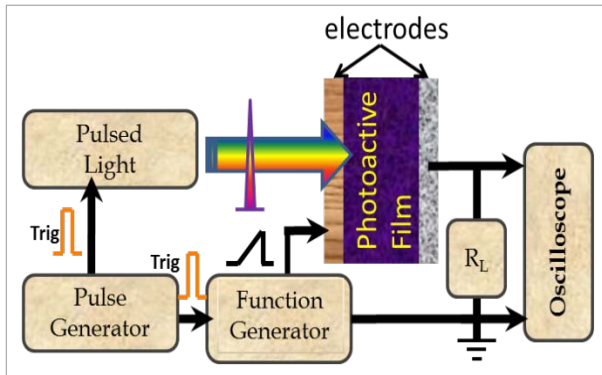
Reference No. IMRE-ACI-0001

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## 3-in-1 Measurement Set-up:

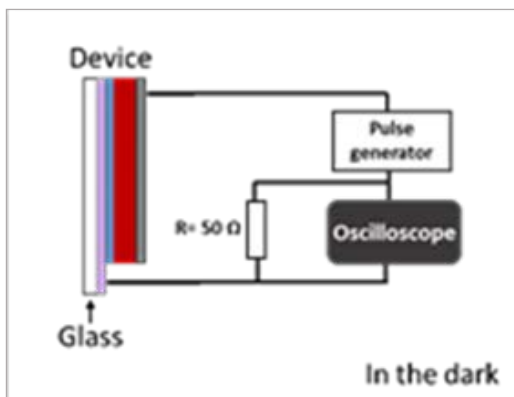
### 1. Charge Extraction by Linearly Increasing Voltage (CELIV)/ Photo-CELIV



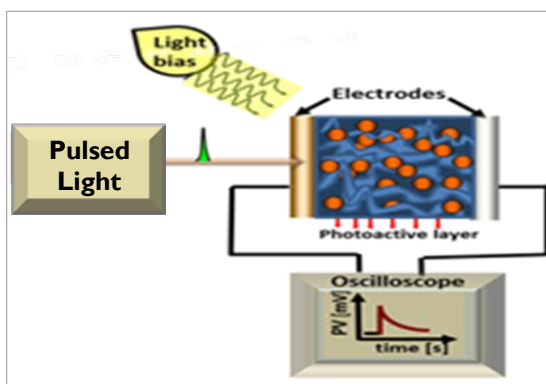
The 3-in-1 set-up by IMRE measures:

- how fast charges move in a semiconductor material or device; the charge mobility is an indication of the quality of the material being measured
- the concentration and the life-time of charges; it is an indication of how good a device performance is
- the degree of disorder, morphological inhomogeneities, influence of dopants, device degradation due to oxygen or moisture
- the electron diffusion coefficient in metal oxides
- metal-organic/ semiconductor interface properties

### 2. Dark Injection/ Double Injection (DI/ DOI)



### 3. Transient photovoltage/ Transient photocurrent (TPV/ TPC)



References:

- Advanced Energy Materials 7, 1602610 (2017)
- ACS Appl. Mater. Interfaces, 9, 42769 (2017)
- Journal of Applied Physics 114, 184503 (2013)
- Applied Physics Letters **95**, 263305 (2009)