

# HIPERION

## Disruptive solar photovoltaics

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# HIPERION OVERVIEW

## ☐ The project in numbers

- 4 years duration (end: 08.2023)
- Grant 10.6 MEUR
- 16 partners (industry, solar installers, research centers)



HIPERION Consortium Agreement  
(GA no. 857775)

CALL IDENTIFIER: H2020-LC-SC3-2019-RES-IA-CSA

Topic: LC-SC3-RES-15-2019

PROJECT ID: 857775

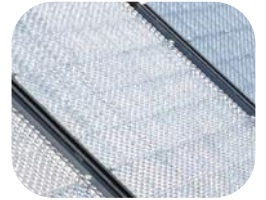
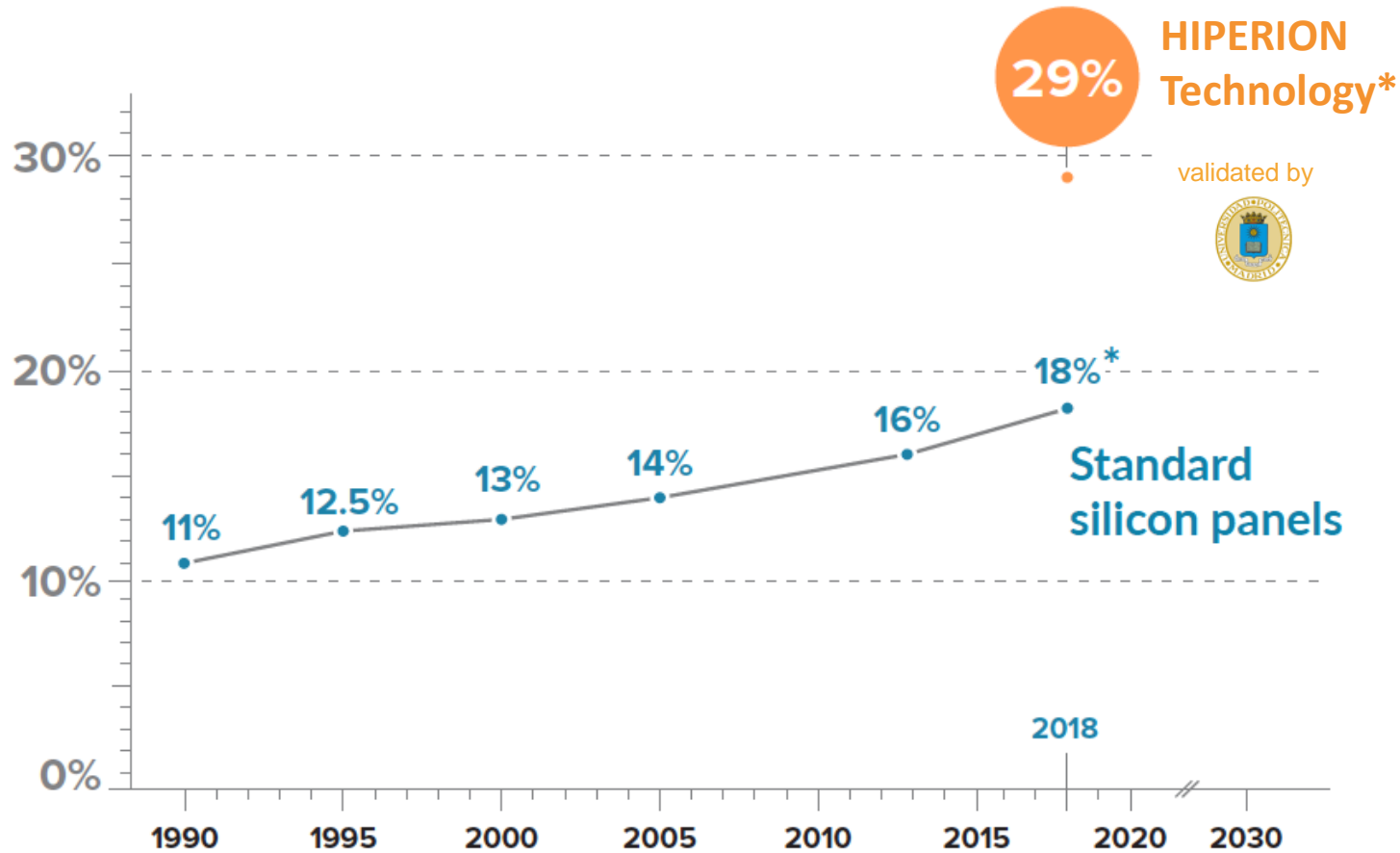
## ☐ Challenge

Increase the competitiveness of the EU PV manufacturing industry with innovative solutions

## ☐ Objective

Demonstrating **manufacturing and product innovation** for highly performing PV technologies at **pilot line level** with potential to be scale-up to **GW-size**

# Breaking the efficiency ceiling of silicon panels

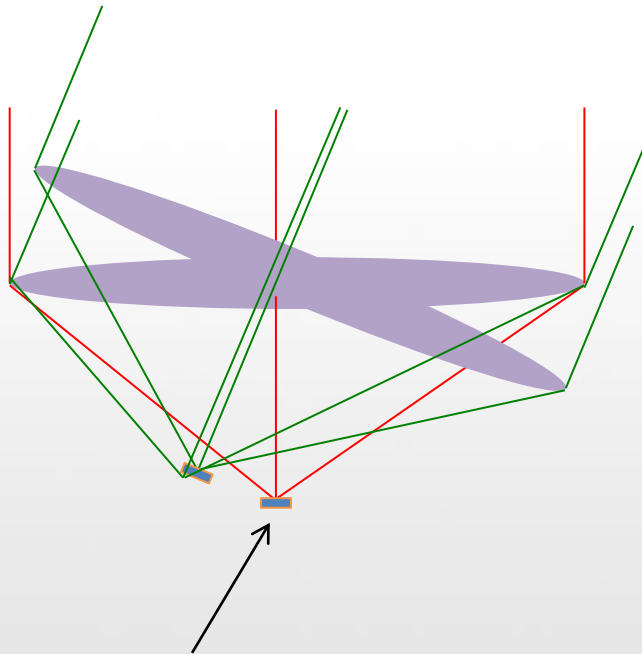


\*source: UPM-IES report

\*source: Fraunhofer ISE PV status

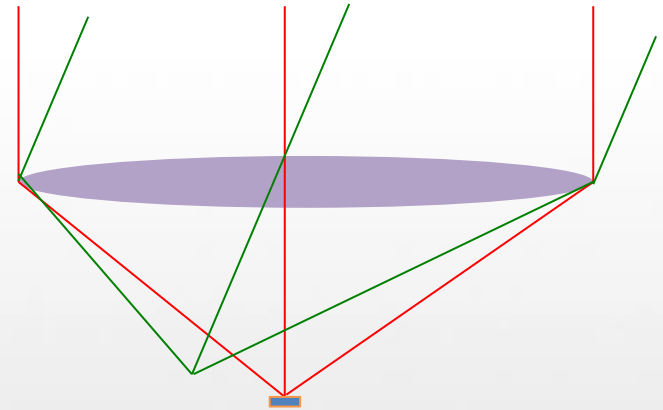
# Concentrator systems: dual-axis vs planar

concentrator system  
(dual-axis tracking)

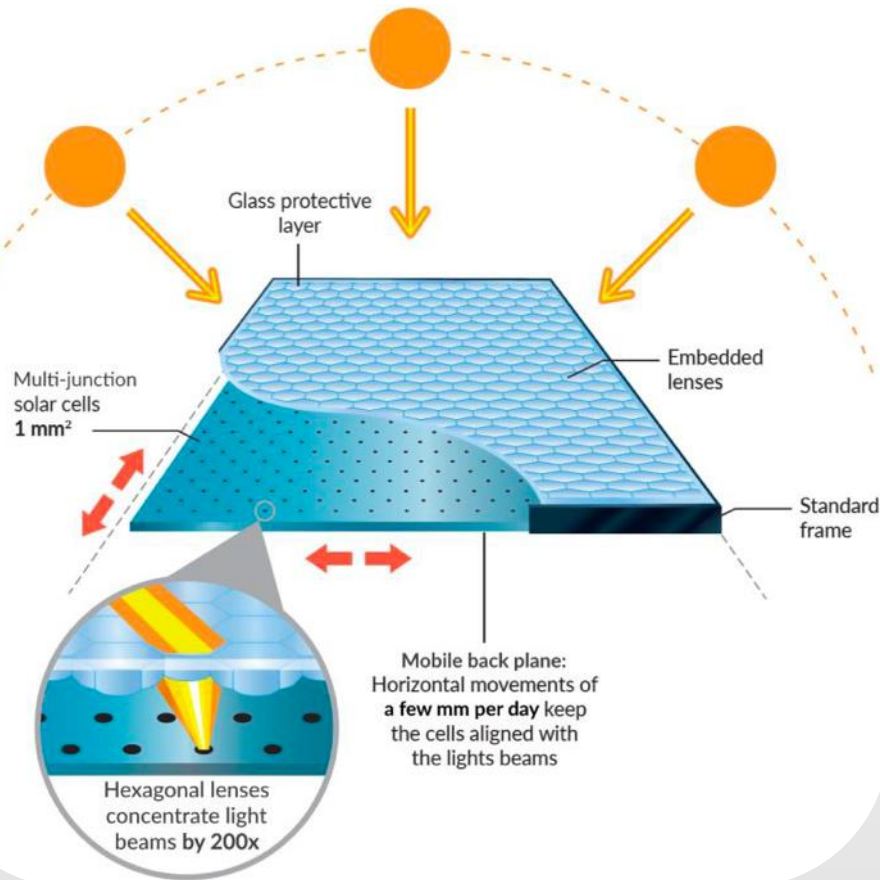


high-efficiency (expensive) cell

planar micro-tracking



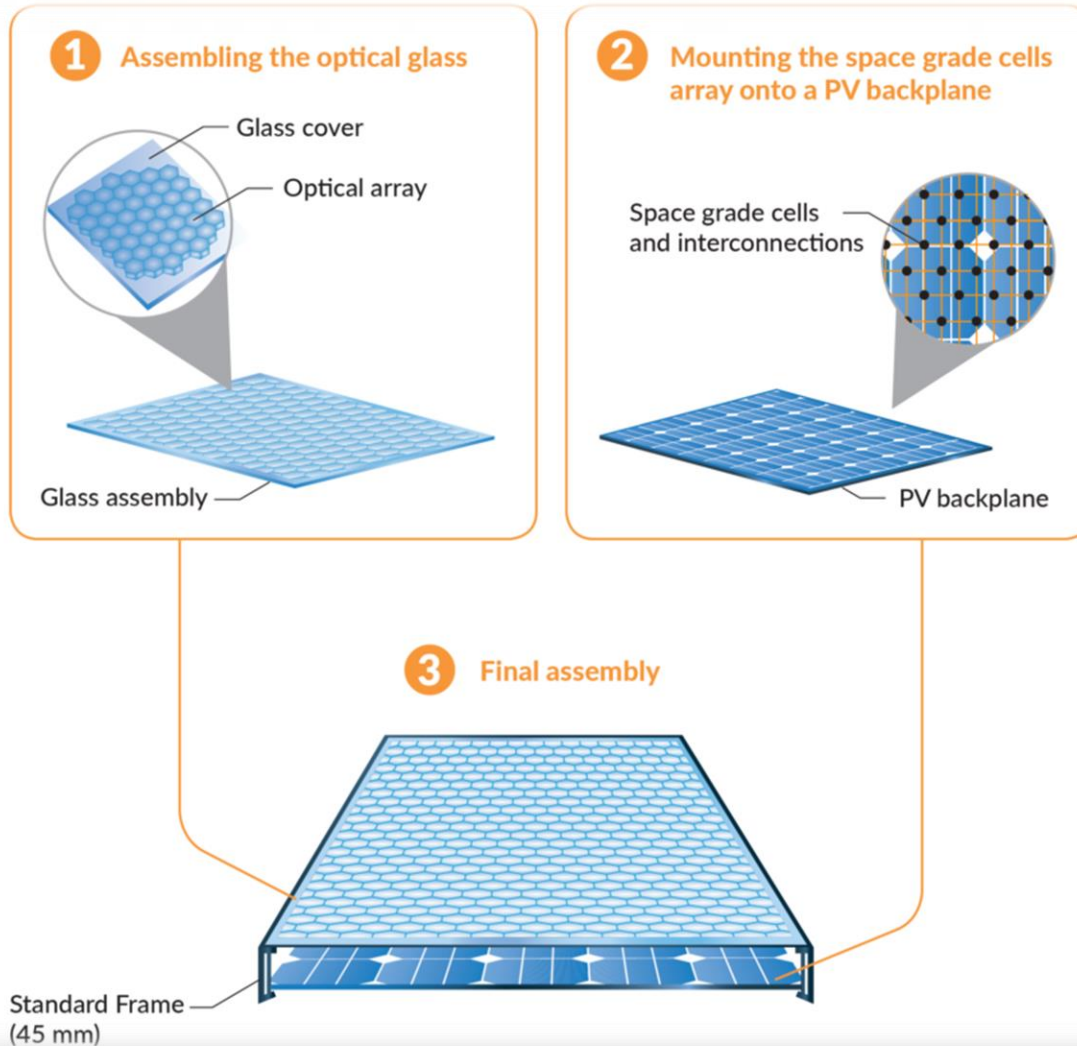
# INSOLIGHT's technology at a glance



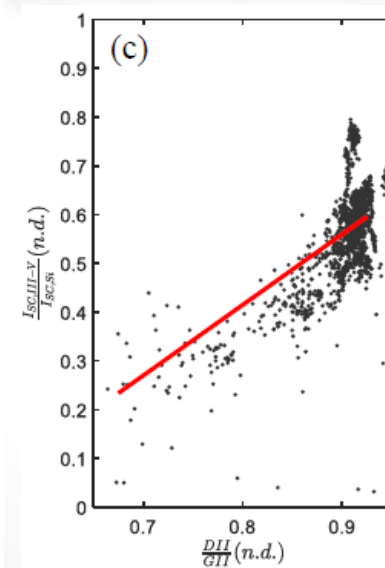
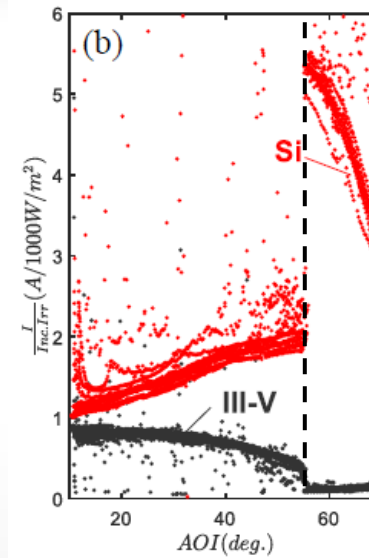
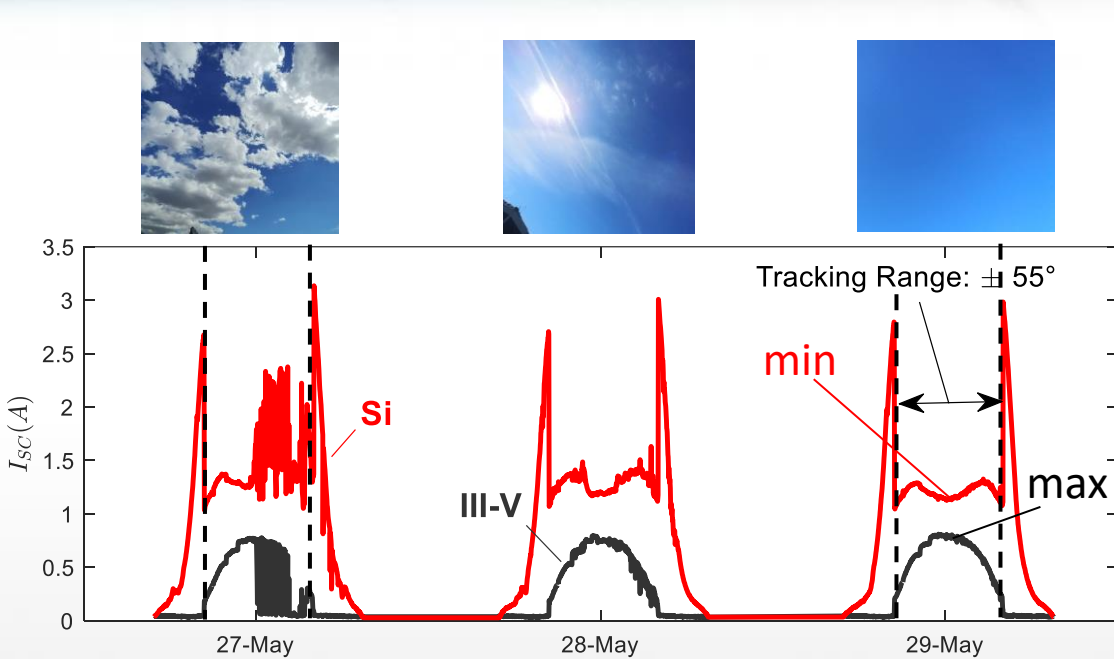
- Sunlight is **concentrated** on an array of highly efficient micro solar cells (multi-junctions)
- **Integrated** micro-tracking (module not moving)
- Standard **flat panel** form factor mountable on any racks or rooftops



# HIPERION hybrid approach



# Operation tests at IES-UPM (Madrid – Spain - 2019)

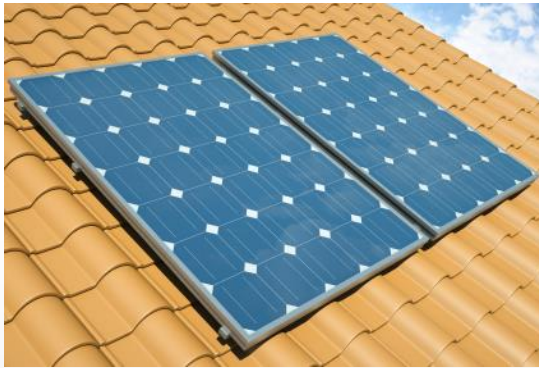


S. Askins *et al.*, IEEE-PVSC 46 (2019).

- ❑ High efficiency solar cells harvest direct light within  $\pm 55^\circ$  acceptance angle
- ❑ III-V solar cell efficiency decreases with increasing AOI (reverse for Si-backplane)
- ❑ Si backplane harvesting increases with DHI/GNI ratio

# Combining the best of PV flat panels and CPV

## CONVENTIONAL PV



- SIMPLE & RELIABLE
- ROOFTOP & UTILITY
- DIFFUSE LIGHT HARVESTING
- LOW EFFICIENCY ( $\approx 20\%$ )

## CONCENTRATED PV



- COMPLEXITY
- UTILITY-SCALE ONLY
- NO DIFFUSE LIGHT HARVESTING
- HIGH EFFICIENCY ( $> 30\%$ )

## HIPERION

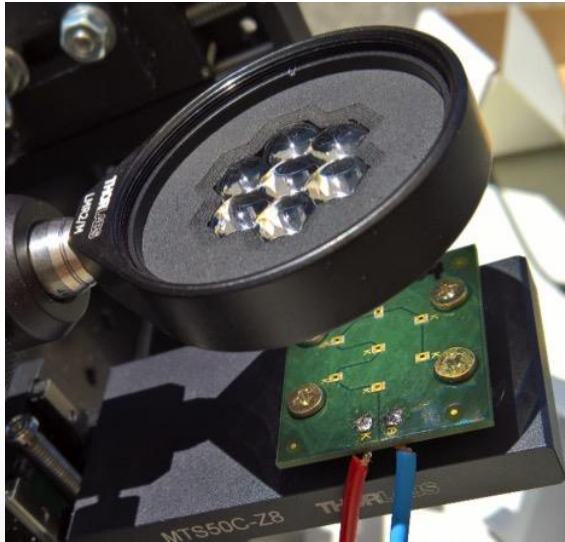


- INTEGRATED TRACKING
- ROOFTOP & UTILITY
- DIFFUSE LIGHT HARVESTING
- HIGH EFFICIENCY ( $> 30\%$ )



# A bit of history: from lab scale to full-size module

2016



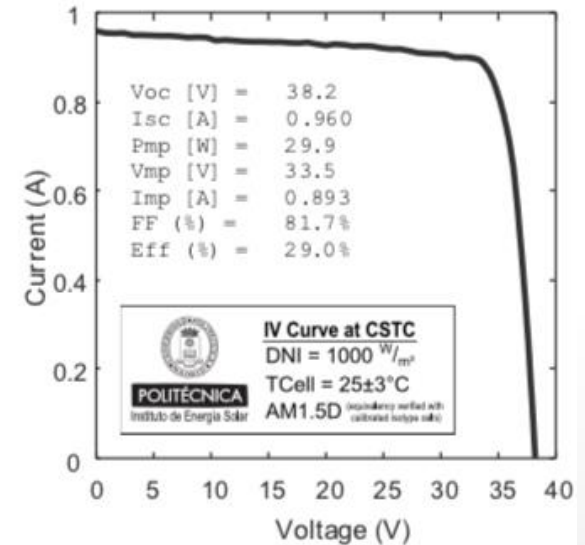
Proof-of-concept  
**36.4%** efficiency [1,2]  
Angular acceptance  $\pm 40^\circ$   
measured at Fraunhofer-ISE

2017



Pilot site @ EPFL,  
Switzerland [2]  
Full modules, encapsulated  
Thousands of cells

2018



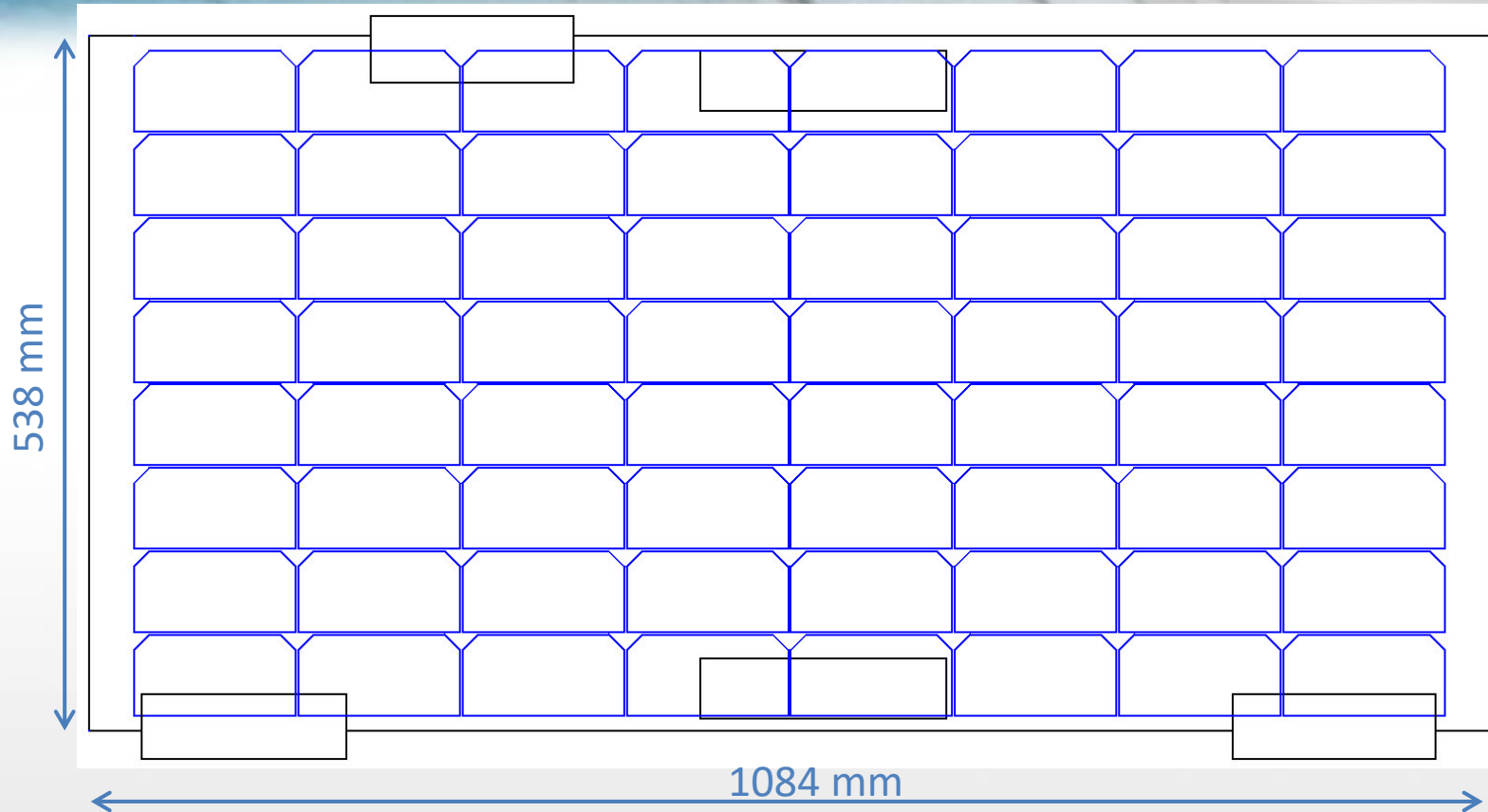
Module performance  
**29.0%** C-STC efficiency  
Angular acceptance  $\pm 55^\circ$   
Measured at IES-UPM [2,3]

[1] Chinello, E. *et al.*, Global Challenges 1, 1700095 (2017).

[2] Nardin, G. *et al.*, AIP Conference Proceedings 2149, 040001 (2019).

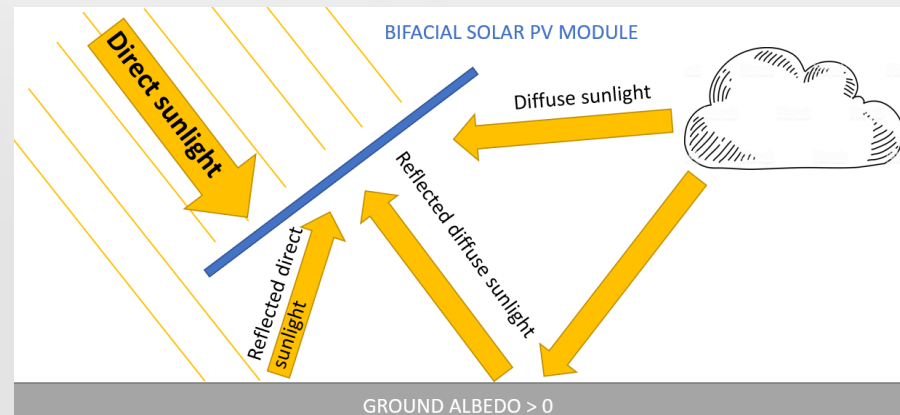
[3] S. Askins *et al.*, IEEE-PVSC 46 (2019).

# 2020: GEN1 module with tandem integration



## High efficiency c-Si backplanes

- **Bifacial cells** → additional current boost
- **Half / shingle cells** → high voltage output, low resistive losses



# HIPERION addresses main PV industry challenges

## Electricity Cost



### No more leverage to decrease costs on EU rooftops

dominated by installations & labor (80%)

## Efficiency



### Limited efficiency for current modules approaching their max at 22%

## Manufacturing margins



### Anemic net margins for manufactures

- 0% average for panels manufacturers<sup>1</sup>

### Boosting module efficiency

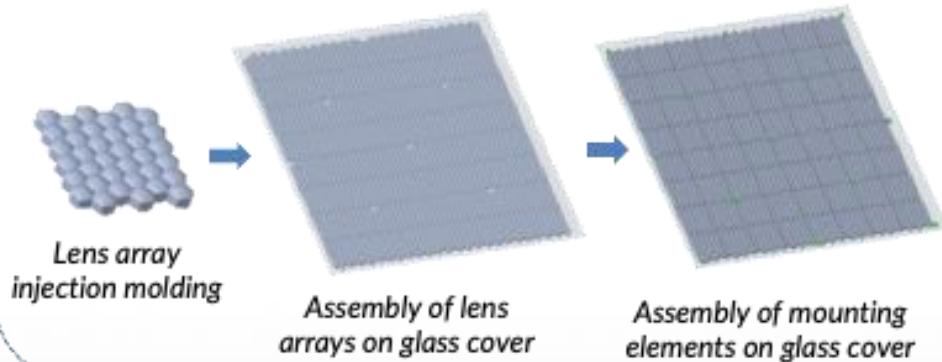
- **lower cost** of solar electricity on rooftops
- **higher margins** for manufacturers



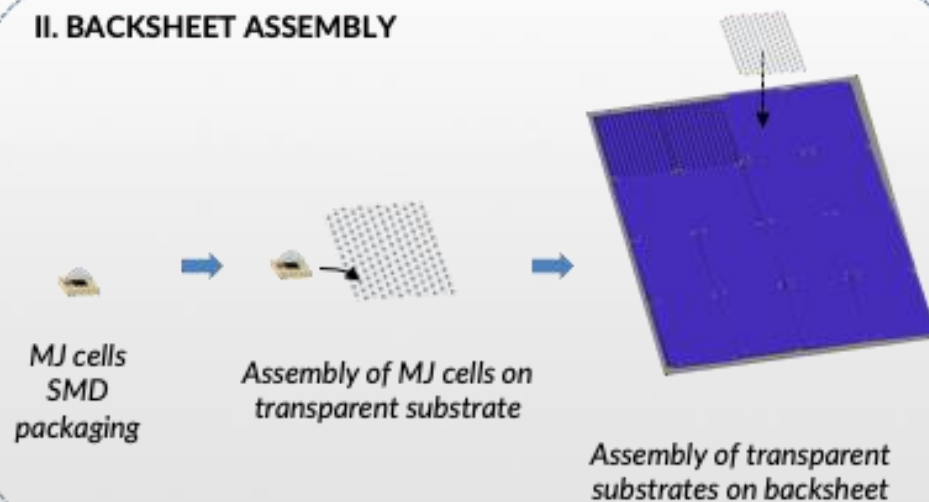


# HIPERION module fabrication

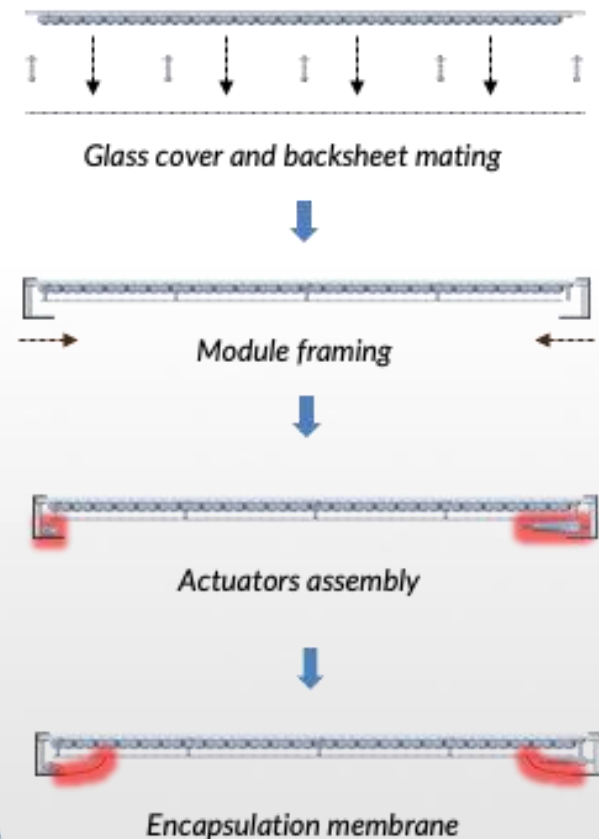
## I. GLASS ASSEMBLY



## II. BACKSHEET ASSEMBLY

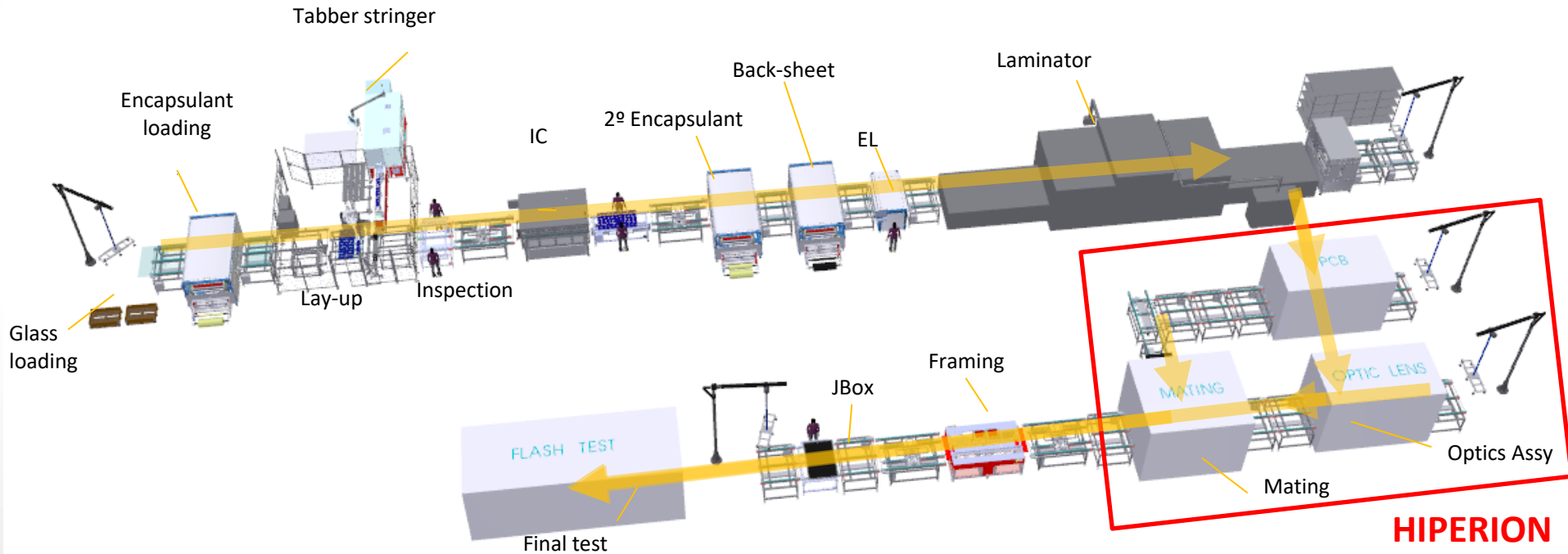


## III. MODULE ASSEMBLY





# Toward GW production line



**HIPERION technology is an upgrade to existing manufacturing line with 4 assembly steps**

- Back plane lamination (existing line)
- PCB/GE assembly
- Optics Assembly
- Mating

# Beyond standard PV...



Insolight translucent PV modules at 29% record efficiency under direct sunlight produce more electricity

direct sunlight

diffuse sunlight

diffuse sunlight



Natural diffuse sunlight illuminates the interior of the building with no shading and no glare

- Maximize land usage
- Integrated planar micro-tracking
  - static module
  - control knob for direct light transmission



# THANK YOU!



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