

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)

Horizon 2020



HIPERION Consortium Agreement
(GA no. 857775)

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

Topic: LC-SC3-RES-15-2019

PROJECT ID: 857775

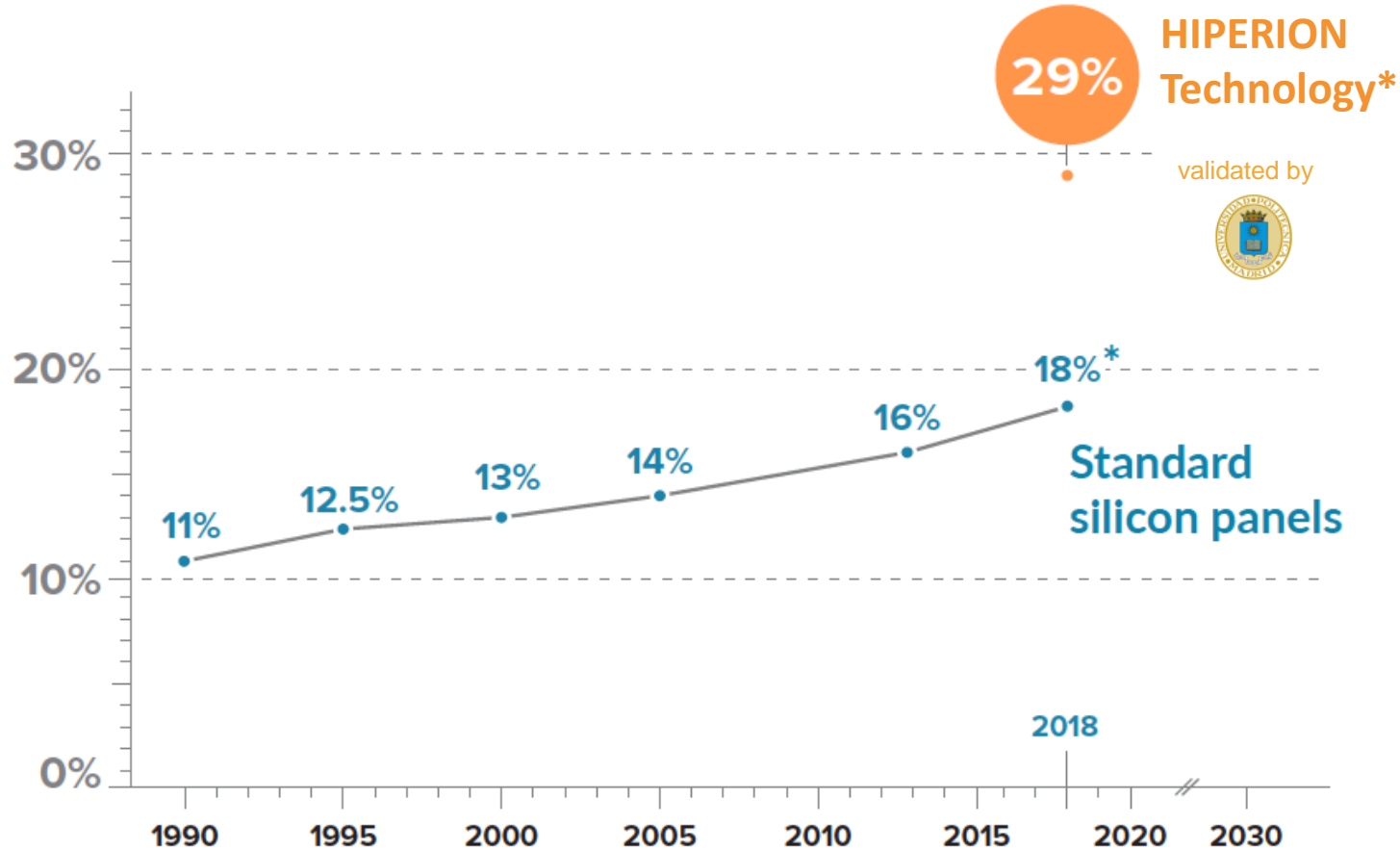
❑ Challenge

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

❑ Objective

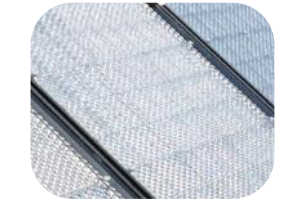
Demonstrating **manufacturing and product innovation** for highly performing PV technologies at **pilot line level** with potential to be scale-up to **GW-size**

Breaking the efficiency ceiling of silicon panels



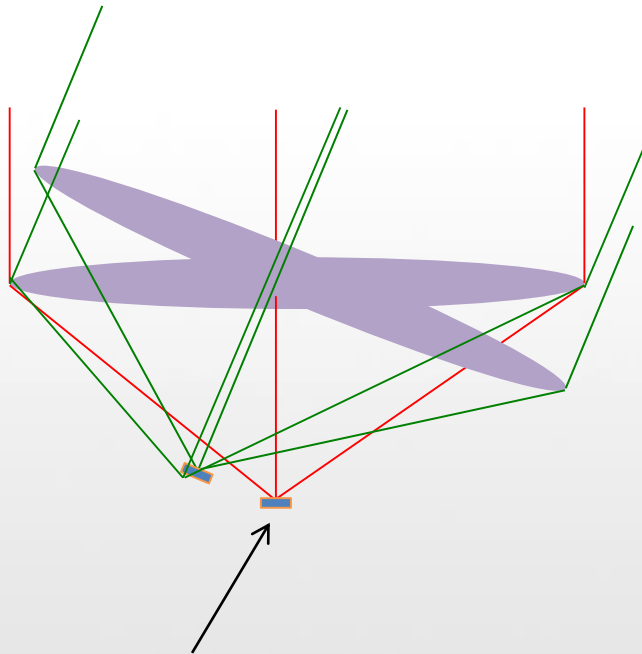
*source: UPM-IES report

*source: Fraunhofer ISE PV status



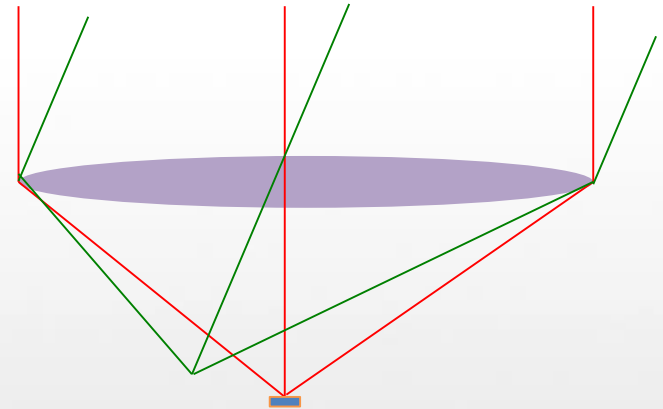
Concentrator systems: dual-axis vs planar

concentrator system
(dual-axis tracking)

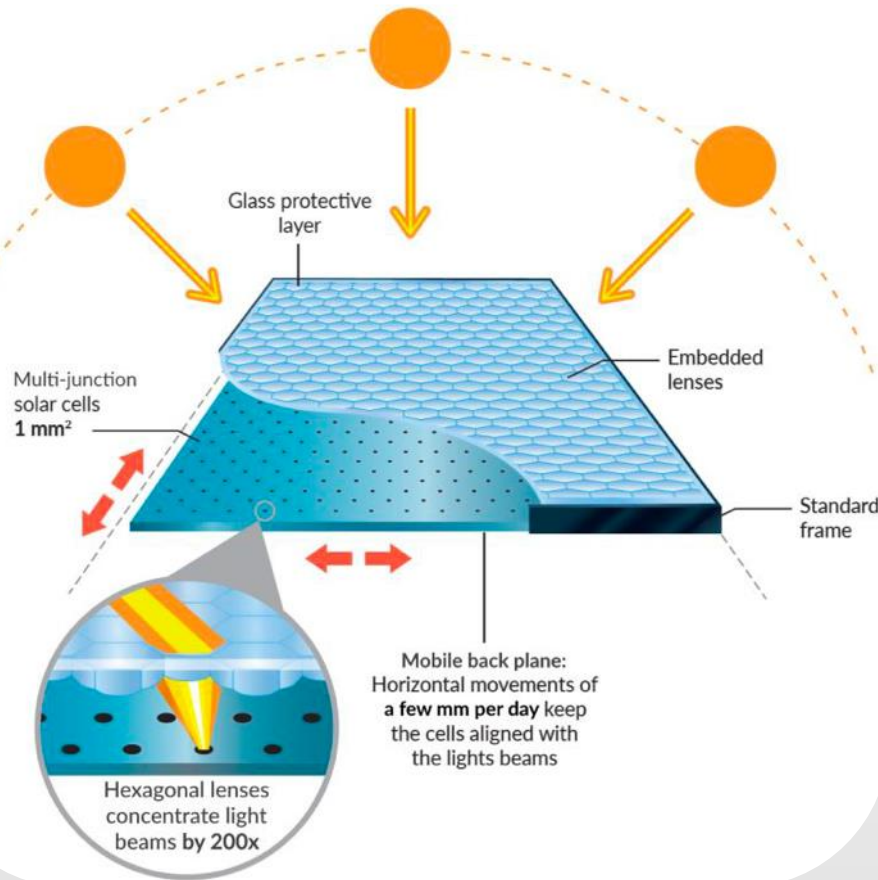


high-efficiency (expensive) cell

planar micro-tracking

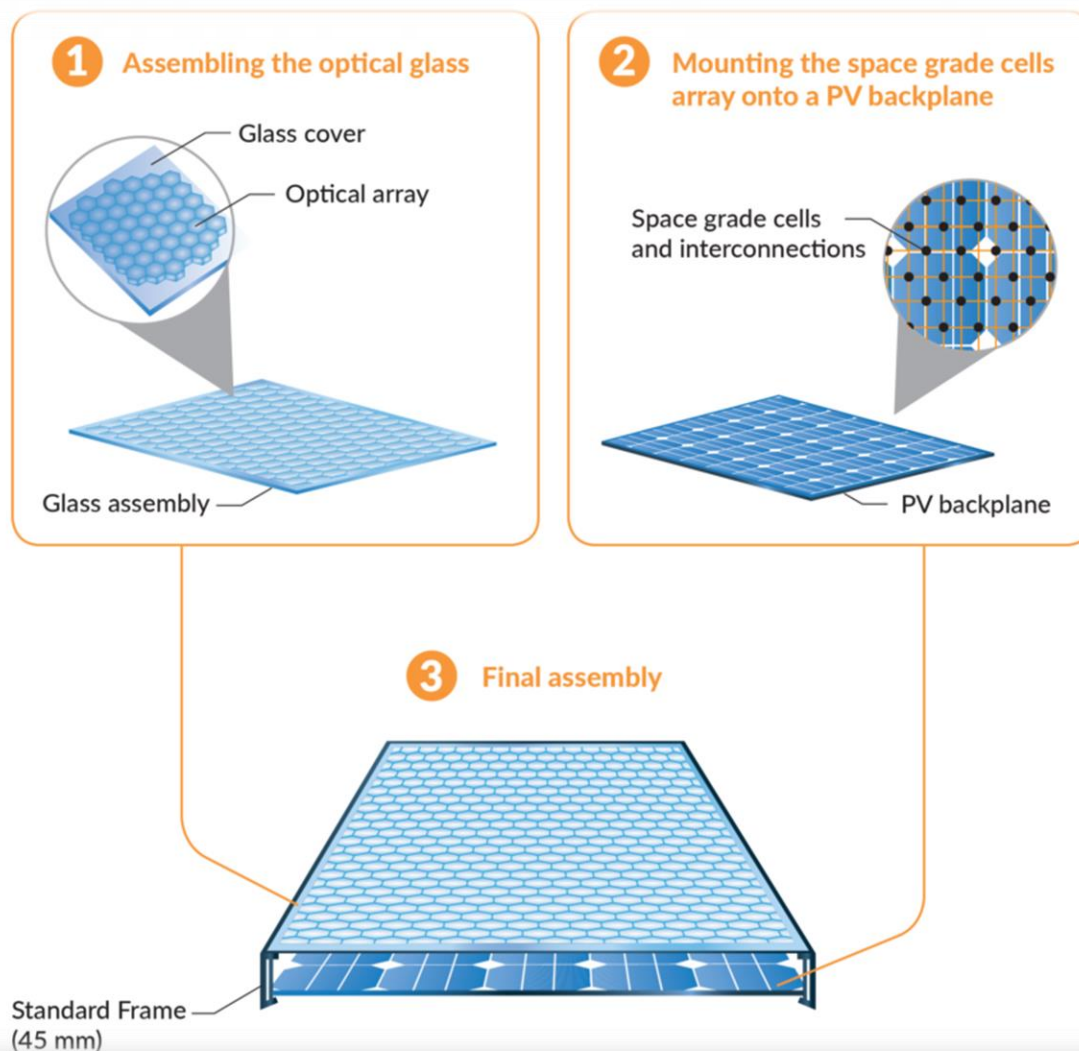


INSOLIGHT's technology at a glance

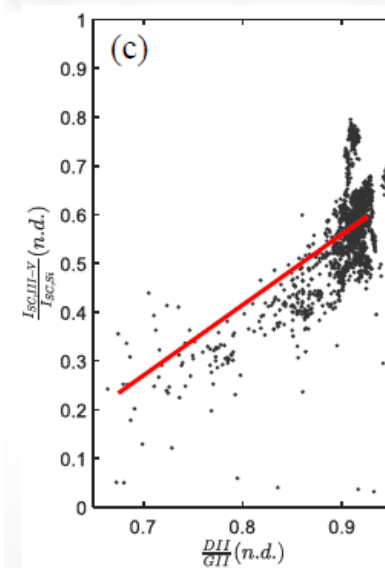
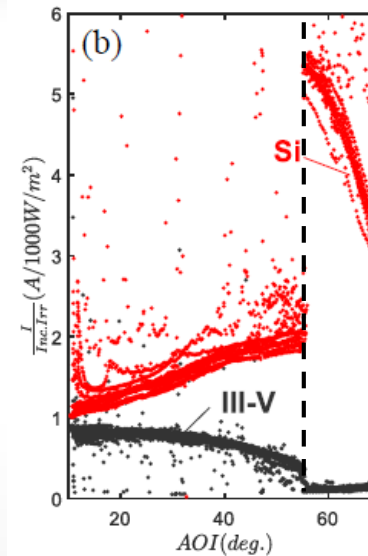
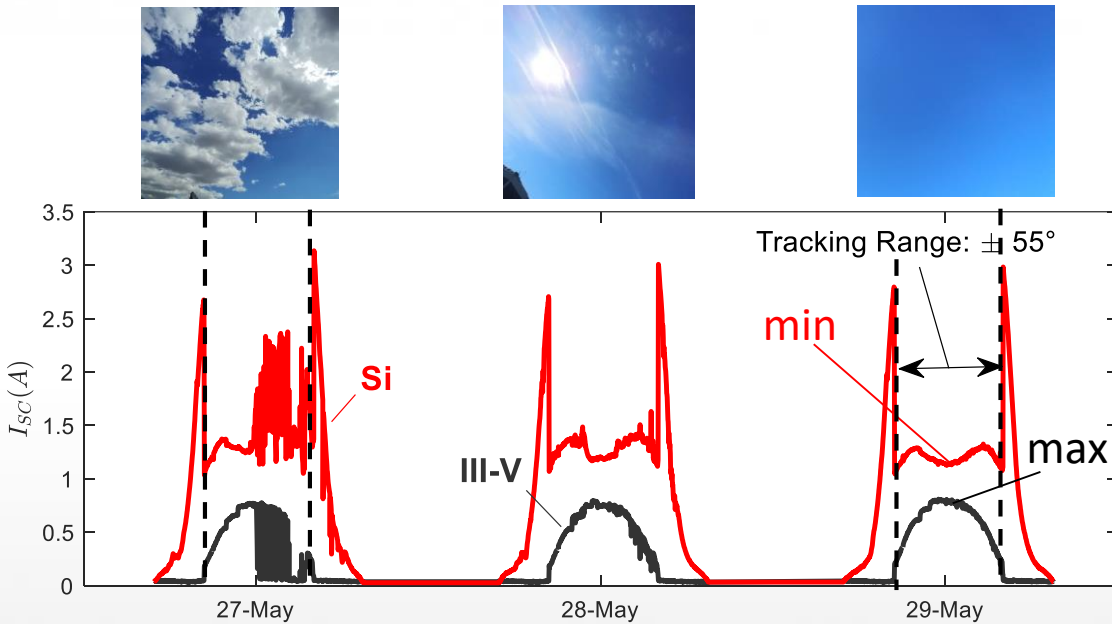


- Sunlight is **concentrated** on an array of highly efficient micro solar cells (multi-junctions)
- **Integrated** micro-tracking (module not moving)
- Standard **flat panel** form factor mountable on any racks or rooftops

HIPERION hybrid approach



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

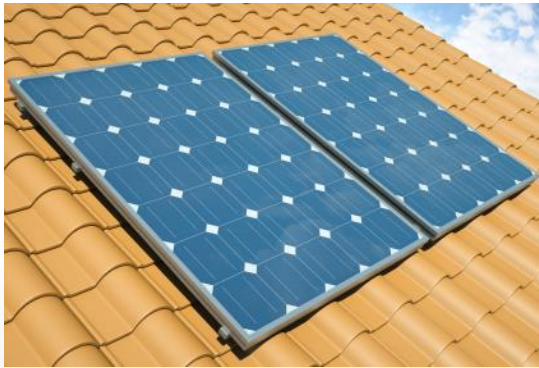


S. Askins *et al.*, IEEE-PVSC 46 (2019).

- ❑ 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 ($> 30\%$)

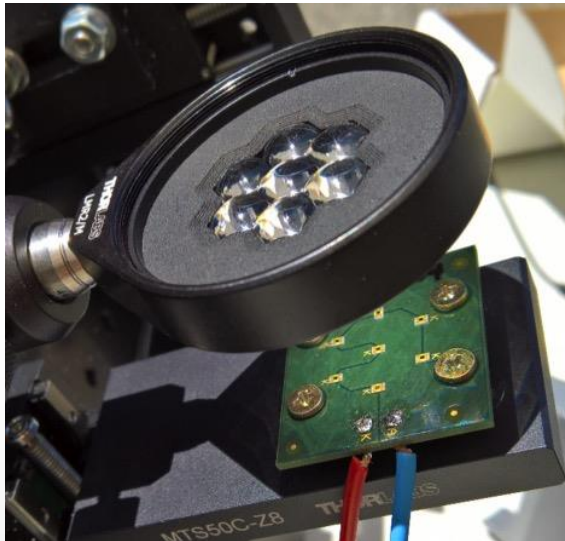
HIPERION



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

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

2016



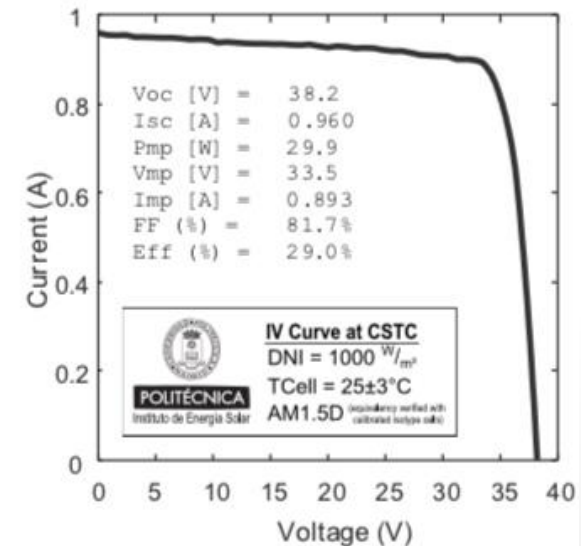
Proof-of-concept
36.4% efficiency [1,2]
Angular acceptance $\pm 40^\circ$
measured at Fraunhofer-ISE

2017



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

2018



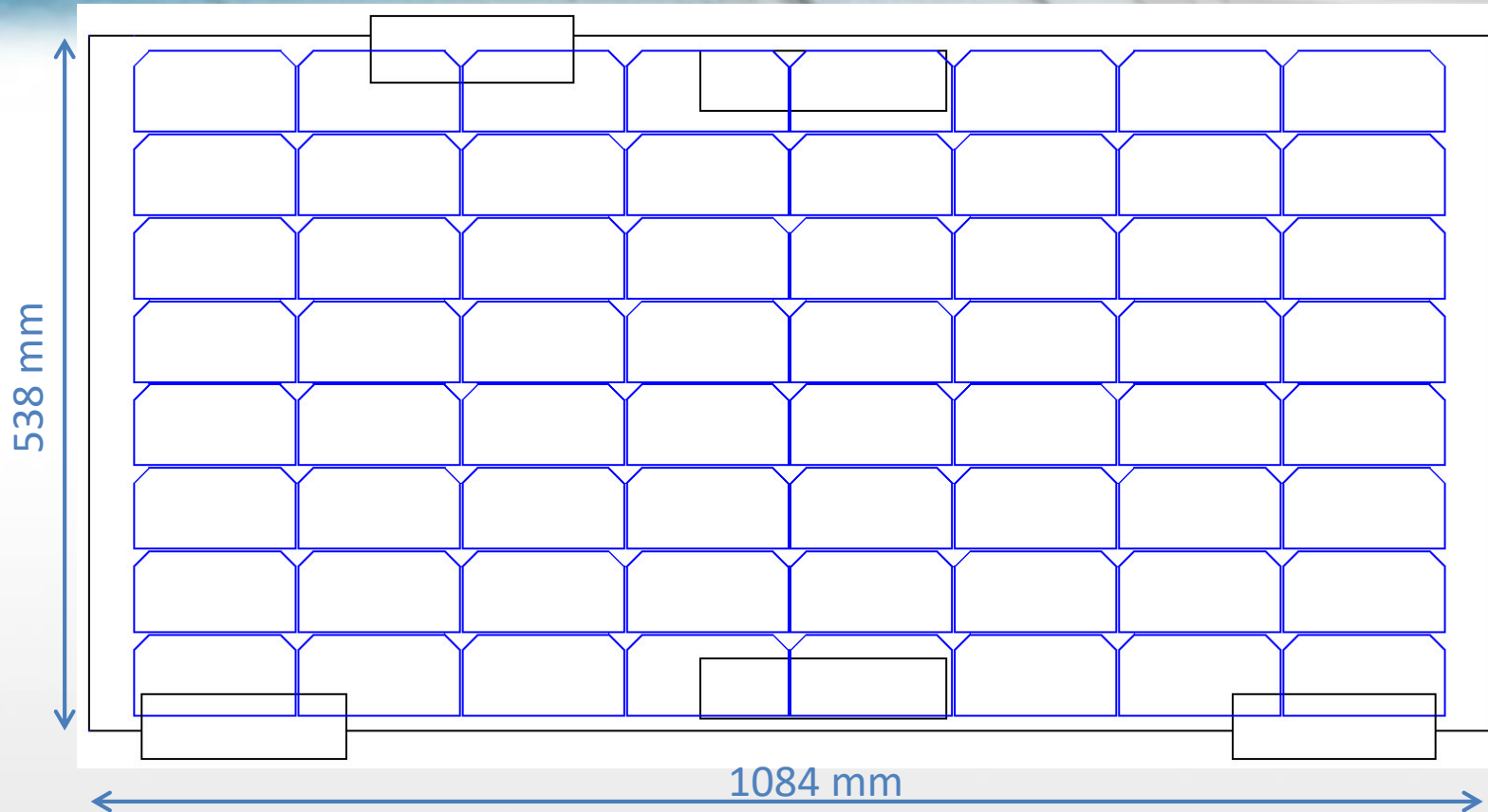
Module performance
29.0% C-STC efficiency
Angular acceptance $\pm 55^\circ$
Measured at IES-UPM [2,3]

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

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

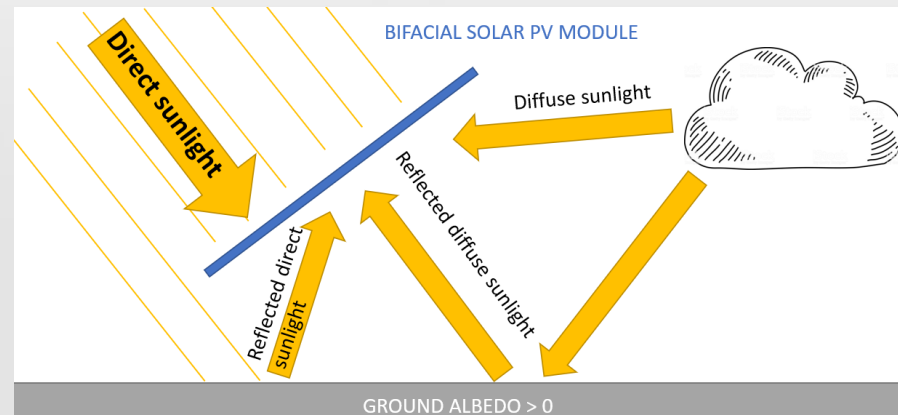
[3] S. Askins *et al.*, IEEE-PVSC 46 (2019).

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 manufacturers¹

Boosting module efficiency

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

High efficiency can allow a faster pay back of the full PV installation chain

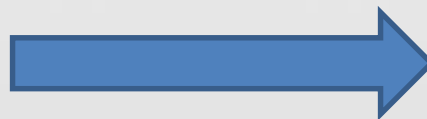
Solar PV value chain



Higher efficiency PV modules produce more electricity and will yield higher returns on the total CAPEX



CapEx \$/m²
HIPERION +32 %

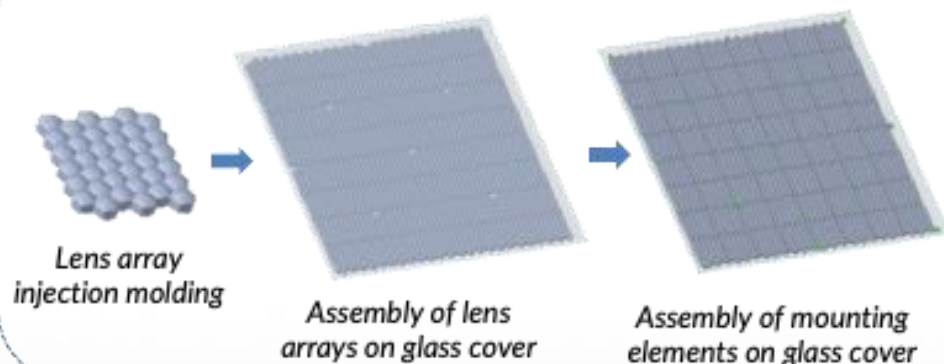


LCOE \$/kWh
HIPERION -15 %

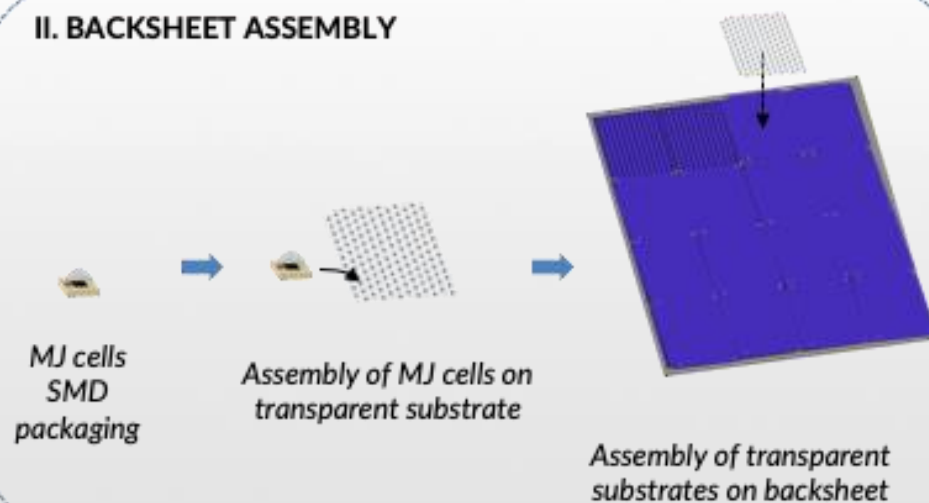


HIPERION module fabrication

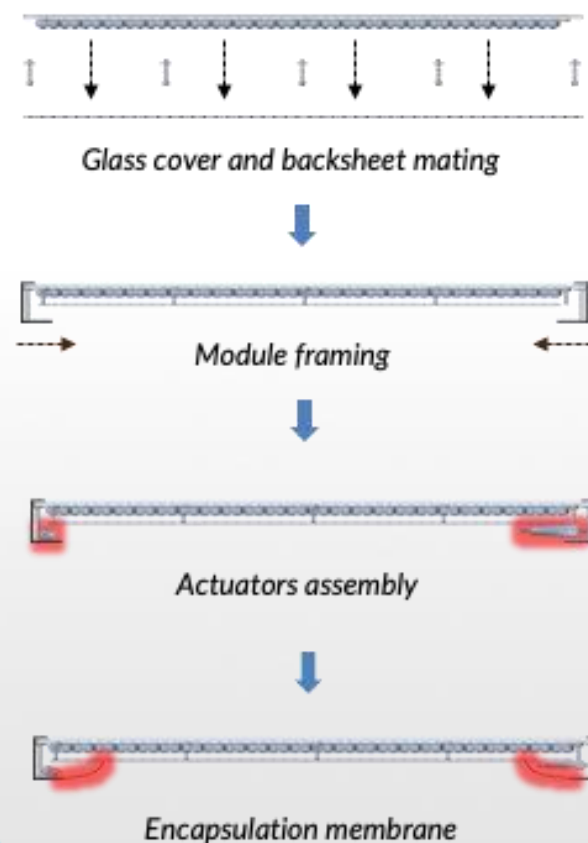
I. GLASS ASSEMBLY



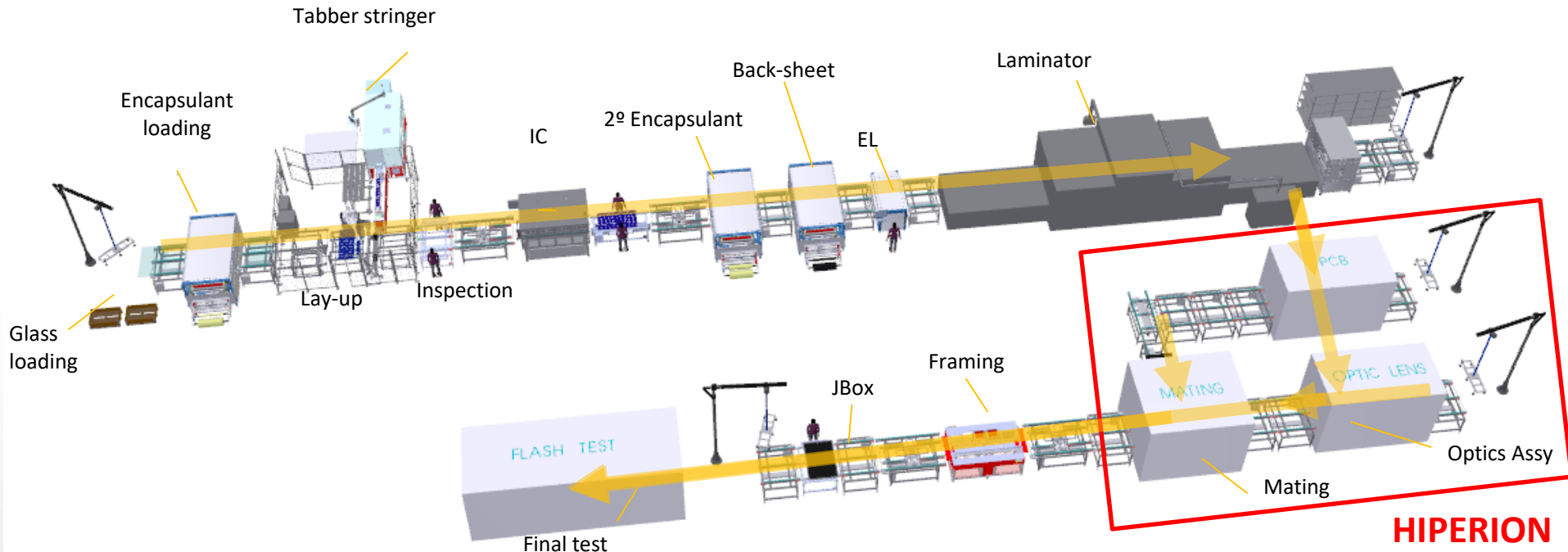
II. BACKSHEET ASSEMBLY



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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