

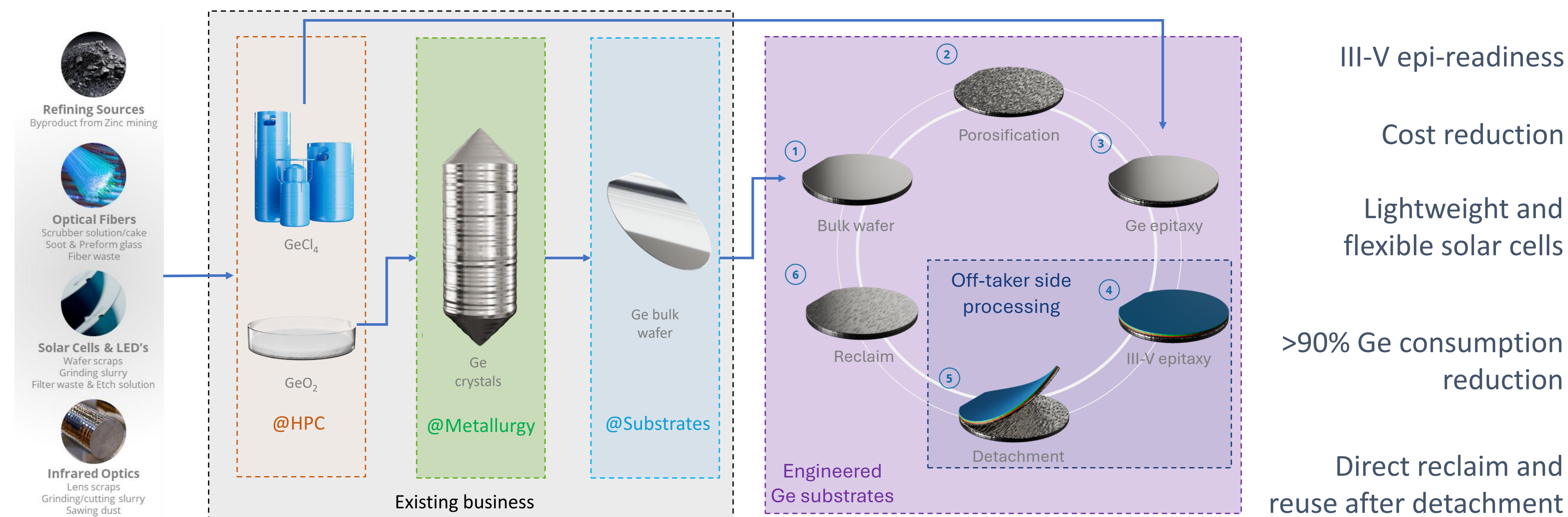
Science-Enabled Agility:

From Bulk Ge to engineered thin Ge foil for next generation multijunction space solar cells

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1) Introduction



2) Engineered Ge substrates: 2 product types

UDS Université de Sherbrooke

Single PGe + Ge-epi

Ge foil (~1 μm)
Detachment plane
Mother Ge substrate

Scale-scale detachment assisted by Ni stressor layer

Solar cell characterization after detachment

200 μm

Icons: Iron, Diamond, Infinity, Recycle

Suitable for III-V layers | Monocrystalline | Functional detached solar cells | Reusable mother substrate | Drop-in replacement product, V1 product

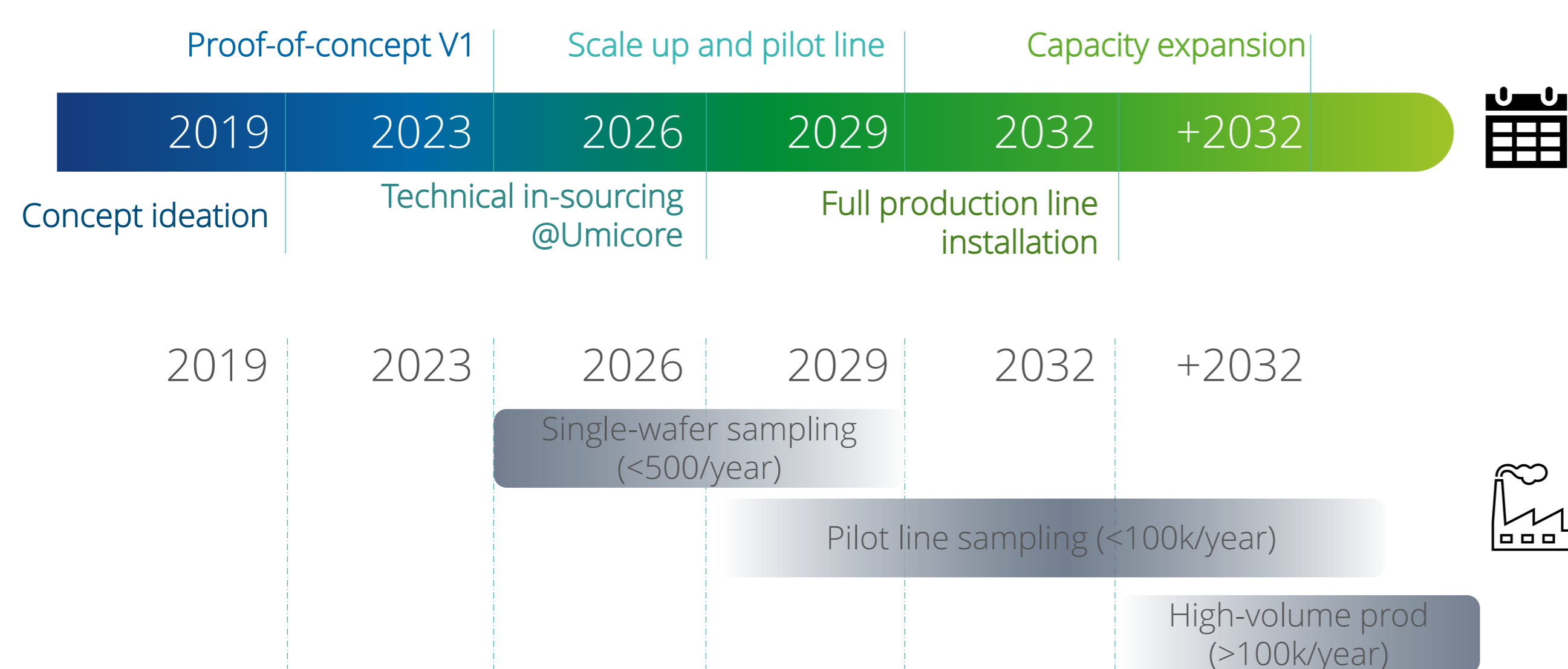
Fraunhofer ISE

Bi-Porous Ge

Icons: Iron, Diamond, Microscope, Infinity, Satellite

Suitable for III-V layers | Monocrystalline | On-going work on detachability | Reusable mother substrate | Good candidate for LEO market and V2 product

3) Timeline & volume forecasts



4) Conclusions & perspectives

Technical achievements and relevance to the market:

- 2 product types developed at Umicore targeting short- and long-term solutions for space solar cells
- Single PGe +Ge epi, more advanced and mature. Targets conventional triple-junctions. Demonstrates functional detached cells at lab scale. Ready for up-scaling and pilot line
- Bi-porous Ge, still under development. Targets new structure (without Ge active layer). Demonstrates functional solar cells. Continuous improvements with downstream partners

Path forward to 2032:

- 2026-2029: scale-up to 6inch and pilot installation
- 2029-2032: Pilot line operation and high-volume production installation
First wafer batches commercially available and production volume ramp-up