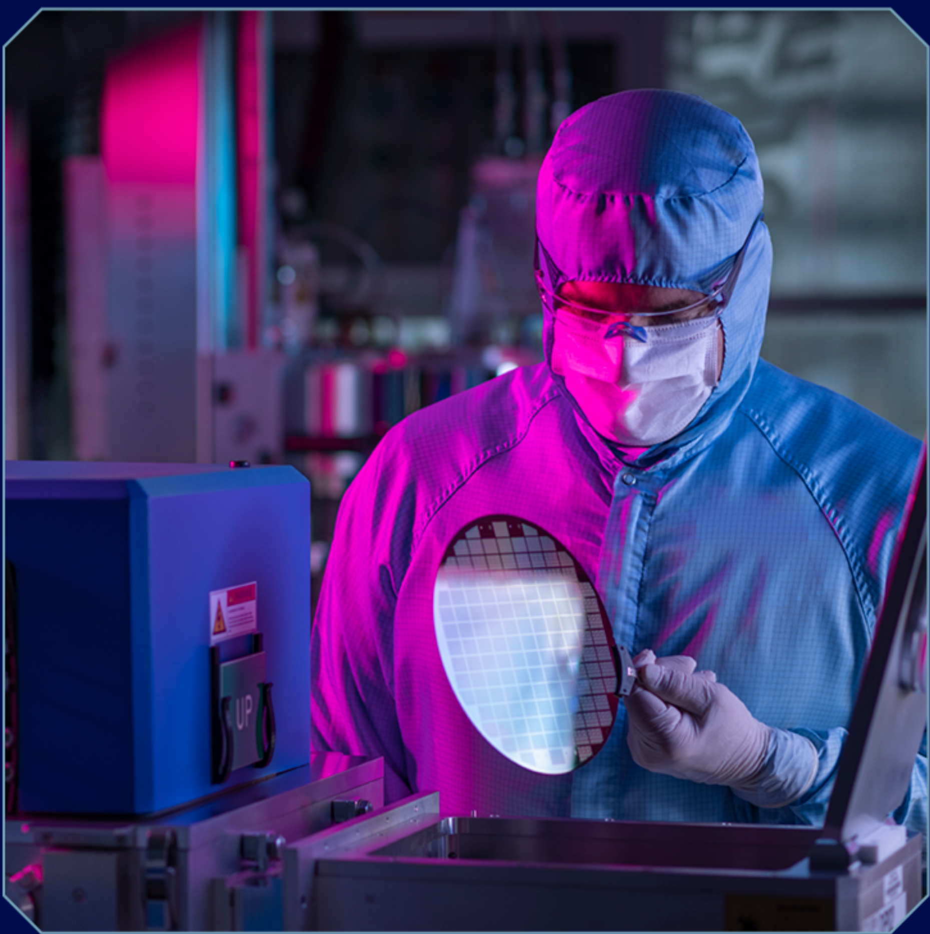
Accelerating UK growth through investment in silicon photonics infrastructure

Policy workshop outputs, 15th of October 2025, London



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EXECUTIVE SUMMARY

The United Kingdom faces a defining moment in deciding on how best to exploit the opportunities offered by silicon photonics (SiPh), the integration of light-based components onto silicon chips with many applications across sectors like AI hardware, advanced connectivity, defence, quantum technologies and sensing.

This report summarises the findings and discussions of a national policy workshop convened by the **CORNERSTONE Photonics Innovation Centre** in October 2025. The event brought together industry leaders, academic researchers, and policymakers to explore how coordinated investment in SiPh infrastructure, alongside other system enablers, could accelerate company growth and secure the UK's position as a global leader. The insights here aim to represent a collective view across industry, academia, and government.

> "Leadership in SiPh is still up for grabs — and the UK has all the ingredients to seize it."

The workshop concluded that SiPh represents one of the most strategically significant opportunities for UK industrial growth this decade, but that the window to act is closing rapidly. Without decisive and coordinated investment, the UK risks losing ground to international competitors that have already begun to build the foundations of industrial-scale production.

At the heart of discussion was recognition that the UK's current model – world-class research excellence without the domestic capability to scale the sector — is not sustainable. A **silicon photonics pilot line** is needed as a semi-industrial facility that bridges the gap between laboratory innovation and scalable manufacturing. Participants agreed that investing in such a pilot line is a crucial missing link that can help transform research excellence into commercial output. A pilot line will enable companies to design, test, and validate new devices and systems domestically, and would help stimulate wider investment in the associated skills, training, and collaboration that are necessary to UK success in this field.

Establishing a high-quality pilot line would signal the UK's intent to take seriously the opportunities presented by SiPh and **establish the country's own model** of doing so – one built around agility, integration, and design excellence rather than scale alone.

Key messages emerging from the workshop included:

- There is definitely an **opening to take a lead in SiPh** as there are no entrenched global incumbents.
- The **opportunity extends across multiple sectors**, including AI hardware, advanced connectivity, defence, quantum technologies, advanced computing and sensing.
- **Domestic manufacturing in photonics is feasible** as demonstrated by existing examples of UK high-volume precision facilities.
- A **national pilot line** is essential infrastructure to bridge research and industrialisation.

- **Clusters of SiPh capability, and related system enablers, around the country should be connected and coordinated**, optimising the investment in test facilities, design capabilities and training capacity into a single, coherent and high-performing ecosystem.
- Funding should blend **government, industry, and institutional finance**.

Immediate next steps include developing a **business case for the pilot line**, undertaking a **cluster audit** to understand exactly the assets and other resources available, and defining a **leadership and governance model** to plan and coordinate action across the SiPh sector. A **single government department** should take the lead in working with companies across the sector, supported by research institutions, UKRI, and Innovate UK.

With coordination, clarity, and sustained leadership, the UK can transform its world-class research base into a complete industrial capability that creates wealth, high-value employment and technological resilience for the country.

BENEFITTING FROM THE SIPH OPPORTUNITY REQUIRES A NUMBER OF CHALLENGES TO BE OVERCOME

Photonics – the science and technology of light – is a foundation of modern digital society. From broadband communication and medical imaging to aerospace sensors and data centres, photonics technologies enable faster, smaller, and more energy-efficient systems. SiPh takes this one step further by integrating optical components onto silicon chips, allowing light rather than electricity to carry and process information. The benefits are dramatic: higher speed, lower latency, vastly improved energy efficiency, and the ability to connect chips and systems at previously impossible bandwidths.

Globally, SiPh is one of the fastest-growing areas within the photonics sector, driven by its ability to integrate optical components with standard semiconductor manufacturing. Yet, unlike mature electronics, no single country or company dominates it. This creates a rare strategic opportunity for the UK, a country with world-class academic strength, agile small- and medium-sized enterprises (SMEs) with cutting-edge photonics technology, and a strong record of product and application design. Despite this, the UK's capacity to commercialise SiPh innovation remains constrained by structural challenges:

- **A fragmented SiPh sector ecosystem.** The UK's capabilities in photonics and semiconductors are spread across a variety of companies, universities and Catapult centres, with regional clusters in places such as Cambridge, Glasgow, Southampton, and South Wales. Without coordination, this "patchwork of excellence" results in duplication of effort, underutilised assets, and slower collective progress. A lack of joint promotion also makes it hard for companies (especially SMEs) to find the testing or packaging support they need.

- **Infrastructure cost and access.** Equipment for fabrication, packaging, and testing is expensive and space-intensive. Once photonic chips are packaged (encased or interconnected with optical and electronic components), testing costs rise sharply, often doubling. In the absence of a pilot line (a semi-industrial facility for testing and scaling photonic circuits before full mass production), companies are forced to rely on overseas facilities for design validation, prototyping, and early manufacturing.

> "We know what to build, but not where we can afford to test it."

- **Skills shortages.** While the UK's pipeline of academics and research is strong, industrial experience in wafer-scale fabrication, advanced packaging, and compound-semiconductor integration is limited. Retention of trained staff is also a concern, as many move abroad to access better-equipped facilities and higher salaries.

- **High energy costs.** SiPh is an energy-intensive sector whose viability (as with other areas of manufacturing) is threatened by high energy costs.

> "Energy is a systemic challenge, not just an electronics sector one."

Without decisive action, the UK risks repeating a familiar pattern: world-class research that others commercialise. In this respect, recent statements that the UK government “supports the UK’s photonics capabilities through targeted interventions,” are welcomed.[1] However, there has been limited visible progress to date and policy ambition needs now to translate into concrete action around infrastructure investment, sector coordination, and sustained funding.

In response to these challenges, the **CORNERSTONE Photonics Innovation Centre** brought together industry leaders, academics, and policymakers in a workshop during October 2025 to explore how coordinated investment in silicon photonics infrastructure and othersystem enablers could accelerate company growth and secure the UK’s position as a global leader.

The overarching question the event addressed was:

How can the UK accelerate company growth through investment in silicon photonics infrastructure and other system development enablers?

The workshop brought together diverse participants to articulate not only technical needs but also governance, funding, and delivery models. The insights here aim to represent a collective view across industry, academia, and government.

[1] Minister **Kaniska Narayan** https://questions-statements.parliament.uk/written-questions/detail/2025-10-10/78493

COMPANIES HAVE SIGNIFICANT AMBITIONS FOR SIPH, BUT THE UK RISKS LOSING THE BENEFITS

Companies and researchers expressed a pragmatic optimism about what the UK could achieve in SiPh if infrastructure and coordination challenges were overcome. The conversation moved beyond aspiration to specifics – what 'good' would look like for the UK, what failure would mean, and where decisive interventions could make the greatest difference.

The workshop underscored how important SiPh is to the future prospects of many UK companies. It is both complementary to existing technology roadmaps but also a potentially disruptive force in the development of new products and services. For example, in defence and aerospace, it enhances performance without displacing existing systems while in sensing, data processing, secure communications and quantum computing, it represents a genuine platform shift.

Furthermore, as devices increasingly 'move to the edge' of networks (e.g. fibre-to-the-room products), this presents many more opportunity for smaller businesses, something the UK investment and manufacturing communities are well-placed to take advantage of.

Participants described a 'coordinated UK ecosystem' that enables companies to design, prototype, and manufacture within national borders. This would connect design houses, pilot line facilities, foundries, packaging and test centres in a seamless pipeline. Within this, the pilot line would allow low-volume production to serve near-term applications such as energy-efficient data centres or quantum networking components.

It was also agreed that there was no reason why the UK should not pursue having a significant manufacturing base that commercialises SiPh technologies. Participants cited Seagate's UK facility as proof that complex, high-value production can succeed domestically, given coordinated leadership and sustained investment. Setting out a clear intent to encourage UK manufacture would also signal confidence and credibility to the international investment and industrial community.

> "Having intent to manufacture gives investors confidence that we're serious about delivery."

The scale of opportunity is realistic, with bespoke manufacturing volumes in the 10ks rather than millions of units. Such low- to mid-volume production suits the UK's industrial profile.

The SiPh technology landscape also has elements that are 'mature' and emerging areas that are much less settled. Companies can benefit from how different development pathways might be scaled up, linking SiPh roadmaps with other key technologies (e.g. quantum, communications, etc.). A pilot line would play a crucial role in supporting that process.

> "Prototyping is an important part of helping build that industrial base."

Accelerating progress requires getting the right balance in the evolution of standards. Standardisation is viewed as an important enabler of collaboration and something that drives investor confidence and provides ways of measuring quality ("putting numbers on a data sheet"). It also leads reliability data and quality benchmarks that reduce barriers to entry for new companies.

> "Standardising too soon may be a problem, given the different ways things might go."

However, there was agreement that the UK should avoid premature standardisation that could constrain innovation and may miss out on capital if development pathways ultimately head in other directions.

The biggest danger is continued fragmentation, with lots of small successes but no national coherence. At worst, this could result in SMEs leaving the UK after being supported in their early development. This would drastically reduce the economic potential of the sector. The example of Salience Labs is an example of this, with US investors capturing most of the value despite the company's success being built on UK-developed skills. The best way to avoid this is to have an effective cluster model that keeps value circulating locally.

> "We could help lots of companies — and they all leave the UK."

FIVE SUCCESS FACTORS ARE NEEDED TO CAPITALISE ON THE SIPH OPPORTUNITY

Workshop participants identified five factors in moving from the industry ambition for SiPh to delivery and commercial success.

1. Clarify and communicate national ambitions for SiPh

Develop a cohesive long-term national SiPh delivery plan

While photonics features prominently in national policy documents, the route to large-scale commercial success remains unclear. Companies need help in building flexible and resilient pathways for scaling up their products, linking research and development, pilot manufacturing, and full production.

This is not simply a matter of funding or facilities – it requires a coordinated approach that brings together academic researchers, industrial partners, and government support. Without clear signals from government about its commitment to the technology, companies and investors push investment and talent toward countries with clearer strategic visions.

A national SiPh delivery plan can set out that ambition and how it will be realised, turning photonics from a fragmented set of research assets into an industrial capability with commercial reach. This plan can set out the UK's competitive position relative to the EU, US, and Taiwan, carving out a distinctive role (e.g. leveraging its system design and interdisciplinary research strengths). In deciding on this, the UK should not be afraid to duplicate or compete directly with other countries as companies value having resiliency in where they can access capabilities and resources.

"We talk about ambition, but we need delivery."

The plan can also apply lessons in:

- how coordinated infrastructure investment and stable public–private collaboration can accelerate SiPh and semiconductor innovation (e.g. IMEC in Belgium and AIM Photonics in the USA)
- using a tiered approach to moving innovations from concept to manufacturing (as in Canada where Université de Sherbrooke performs prototyping, CTMI runs a pilot line, and IBM and Teledyne undertake commercial-scale production).

Understand company ambitions to develop flexible and resilient roadmaps tailored to the UK's strengths

SiPh is at once an established and an emerging technology area. This duality creates both opportunities and challenges. Its applications are mature enough to have proven impact (e.g. in data communications), yet it remains sufficiently novel that its full potential is still evolving (e.g. in relation to sensing and quantum computing). The UK's investment in SiPh should embrace both the need to speed commercialisation where that is possible now, while also ensuring sufficient flexibility and resilience to adapt as the technology landscape develops.

UK-specific technology roadmaps can help steer decisions on this. Understanding different company roadmaps should be a starting point, as currently there is not much connection or alignment across the sector. International roadmaps are also valuable models to draw on (e.g. the EU's Photonics21, and the Netherland's PhotonDelta and USA's MIT joint Integrated Photonics Systems Roadmap) but any learning must:

- be tailored to the UK's situation and particular strengths
- reflect the breadth of the market opportunities
- integrate with the roadmaps for other technologies that are critical to the future of SiPh (e.g. quantum computing).

Contribute to the development of SiPh standards

The UK should contribute to the development of international standards (e.g. around wavelengths and testing methodologies) where this help accelerate high quality testing but do not hold back innovation. Robust process design kits (PDKs), reliability frameworks, and open data standards suited to the UK's agile SME ecosystem should also be put in place.

> "We need to know what will be tested — otherwise companies can't prepare."

2. Roll out a pre-competitive pilot line facility

Build the pilot line business case

A shared, semi-industrial pilot line is the missing link in the innovation chain and investment in this was fully endorsed by workshop participants. Without this essential anchor infrastructure, UK firms risk remaining dependent on foreign capacity and losing first-mover advantage. The pilot line should be treated as a national, pre-competitive asset.

A structured business case should be developed with input from DSIT, UKRI, and Innovate UK. It can be challenging to demonstrate a clear economic impact at this stage, as SiPh is an emerging technology, with applications across various sectors often driven by start-ups. The business case can draw on existing industry- and academia-led proposals, consolidating and expanding the evidence of industry commitment and demonstrating that market demand already exists. Using international comparators can provide evidence of the longer-term economic returns on investment.

The workshop recommended a blended co-funding model for the pilot line. Initial government support for CAPEX can be augmented with smaller milestone-based funder grants and longer-term capital from the likes of the UK Infrastructure Bank. Financial contributions from industry could be based on usage, with participants at the workshop indicating that individual companies might each reasonably expect to spend £2-5m per year with the pilot line.

Design an appropriate governance and operational model

It was recommended that the pilot line be established with a core facility supported by a wider ecosystem of collaborators and partners, both across the UK and in other countries (e.g. Tyndall National Institute in Ireland). Universities will be key in driving the capabilities of the pilot line, but it is critical that there is should strong industry involvement (possibly including a number of 'anchor companies' to give visibility of how technology roadmaps might be evolving).

Governance of the pilot line must be transparent, credible and seen to serve the interests of the whole SiPh sector. Industry representation must be balanced by public accountability to maintain trust. Participants recommended establishing a national coordination function, possibly under the UK Semiconductor Centre or as a dedicated community of interest. This would provide oversight, coherence, and a point of contact for industry, ensuring the pilot line and related initiatives move in step. The approaches in Canada and Germany (Fraunhofer Institutes) can provide some useful lessons (e.g. around ensuring good access for SMEs, dealing effectively with IP issues, etc.).

3. Specify the pilot line's technical and product capabilities

Implementation of a new SiPh pilot line requires decisions on its technical and product development capabilities with regard to:

- Emerging materials (e.g. lithium niobate, barium titanate, graphene or other layered materials, etc.)
- Compound semiconductor integration (monolithic, heterogeneous, or hybrid)
- Wafer size (300 mm vs 200 mm)
- Sub-system design (electronic, photonic, mechanical and thermal etc.)
- Wavelengths, advanced packaging and testing methods
- Support for full systems integration and system-level design workflows
- Other 'system enablers' (such as foundries and fabrication lines, design tools and PDKs, etc)

Not all these questions can be settled now and, indeed, it is not necessary to offer everything on day 1 of a pilot line launch. It is though, critical to make and stick to the initial decisions on these so that the pilot line 'offer' is predictable for companies such that they can build the use of it into their planning.

The immediate task therefore is to engage across the sector to identify the critical 'must haves' for the business case and, beyond that, to use technology roadmaps to anticipate which capabilities are likely to be worth subsequent investment further down the line, once the SiPh technical landscape evolves and demand matures. The workshop did, though, provide some initial pointers on these technical and product development capabilities for the pilot line:

- The aim should be to cater for the requirements of different applications, including both the more established (telecoms, data centers etc.) and the emerging (e.g. sensing and imaging). This should not necessarily introduce any technological conflicts (e.g. in terms of which wavelengths the pilot line is working with).
- It will be important to try and accommodate emerging materials (such as lithium niobate, graphene and barium titanate) within the pilot line to maintain technological flexibility. The cost-benefit analysis for each of these should be based on likely demand across the UK. High-quality contamination control and clean-room standards would also be critical to ensure reliability and reproducibility.
- Heterogeneous integration is the most practical path for integrating compound semiconductors with silicon photonics, but the development of monolithic integration could play to UK strengths, while hybrid integration can play a useful role in small-scale prototyping and the development of niche systems (e.g. sensing, lab instruments). Both 2.5 and 3D integration will also be key and a strength of the UK. As integration is very application-specific, the capabilities to support this would need to be available through the wider ecosystem the pilot line is part of.

> "Future success lies in hybrid integration — not one material, but many working together."

- 200 mm diameter wafers offer affordability and flexibility, while 300 mm is needed for certain applications that demand higher performance and offers scale, albeit at higher capital costs. A cost-benefit analysis is required to select the wafer size.

- System-level enablers such as packaging, testing (e.g. quality measures for scaling-up), foundries and design tools are all equally crucial in building a functioning SiPh ecosystem around the pilot line (and contribute to building a viable domestic manufacturing base).
- The pilot line should support complete system development, not just isolated device fabrication, by helping with electronic, photonic, mechanical, and thermal subsystem design.
- Partnerships should be used to bring in additional design capabilities as demanded (e.g. photonics, electronics, systems, network) alongside relationship building with providers of electronic design automation (EDA) software and PDKs, so that designers have support for their future product development in comparable ways to the electronics world.

4. Connect and coordinate the work of the photonics clusters to maximise collective progress

Strengthening the UK's SiPh ecosystem begins with understanding it better. The UK's existing photonics clusters (in South Wales, Scotland, cambridge, and the South) are seen as the critical building blocks to capitalising on the SiPh opportunity. In particular, clusters can support the local recirculation of value, ensuring skills, investment, and supply chains remain in the UK.

> "A strong cluster model lets value circulate and stay in the UK."

Each cluster has distinctive strengths and an audit should be carried out to map their assets and capabilities. This can also identify:

- strategic gaps at a national level which need to be filled
- where duplication helps capacity and resilience or where there is scope for reducing unnecessary overlaps (having "everyone doing something together" rather than "everyone doing everything")
- how planning and governance works locally, with a view to increasing levels of coordination and cooperation (some clusters have formal arrangements while the relationships in others are much looser).

At the same time, a national roundtable could be convened to understand cluster ambitions, identify synergies, explore collective interests/priorities, and assess which engagement methods or incentives would be needed to build commitment and collective working.

A sustainable high-skilled workforce is another decisive factor in the success of the SiPh sector. University semiconductor teaching could be extended to include photonics-specific modules alongside the introduction of specific technician apprenticeships, and mid-career reskilling courses. Upskilling in photonic EDA and cross-disciplinary design are other areas for urgent investment, with hands-on training across all these areas could be tied directly to the pilot line.

> "Skills and expertise are a huge draw — we must maintain and train more. You can't learn packaging from PowerPoint."

5. Create clear and compelling communication about the SiPh opportunity and the actions needed to capitalise on it

The UK needs a clear and confident message to communicate the potential of SiPh and the way that can be realised. This must go beyond technical audiences to policymakers, investors, and even the public, to position SiPh as a strategic technology which ties into national priorities on growth, security, and sustainability. The aim should be to establish 'SiPh' (or a similar term) as a memorable label for policy makers and non-technical audiences, in the same way as 'quantum computing' has caught the popular imagination.

> "We should be louder, more confident — the UK has the story, it just hasn't been told well enough."

The workshop suggested coordinated marketing through techUK, Make UK, and the Photonics Leadership Group, highlighting SiPh as a strategic enabler of economic security and net zero. Participants also urged stronger lobbying and public communication to raise awareness of the sector's potential and secure funding and policy support.

NEXT STEPS

Workshop participants emphasised that success depends on decisive action, not repeated consultation. To guide this, a number of immediate next steps were recommended along with a number of medium- and long-term milestones.

> "If we wait for perfect alignment, we'll wait forever — the point is to start."

IMMEDIATE (0–12 MONTHS)

- Establish a cross-industry steering group to maintain momentum and define delivery.
- Commission an economic impact analysis and a national cluster audit.
- Begin developing the pilot-line business case, including decisions on technical capabilities, emerging materials, and governance models.
- Secure initial funding (e.g. from Innovate UK and/or the UK Infrastructure Bank).
- Communicate early intent publicly to raise awareness and build confidence.

MEDIUM-TERM (12–36 MONTHS)

- Publish the full pilot line business case, including the agreed organisational model.
- Establish more effective coordination across SiPh sector actors/clusters.
- Launch cluster-led joint demonstrator projects to showcase national capability and illustrate the value of collaboration.
- Develop a communications campaign to maintain investor interest and policy visibility (e.g. a 'Photonics Day', linked regional events, etc).

LONG-TERM (3–5 YEARS)

- Launch fully operational pilot line, serving both SMEs and large firms, embedded within a functioning national ecosystem.
- Track impact metrics such as company growth, exports, inward investment, and job creation.
- Strengthen international partnerships and embed the UK within global supply chains and standards forums.
- Consolidate the UK's reputation as a key player in the global SiPh landscape.

CONCLUSION

The workshop closed with a sense of optimism and urgency. Participants agreed that SiPh unites the UK's core strengths in areas such as materials science, design, manufacturing, and innovation. It offers a practical and symbolic opportunity for the UK to demonstrate that it can turn world-class science into world-beating industry. It is a field where the UK can and should lead.

> "If we coordinate our efforts, align infrastructure and skills, and move at pace, the UK can lead in silicon photonics. The opportunity is within reach, but not without commitment."

However, research excellence and a number of emerging clusters is not enough. More investment is needed to build the required infrastructure, skills, and coordination. Now is the time for the UK to catch up with those countries that are showing the way.

Realising this ambition requires clarity of purpose, partnership, and persistence. It also needs shared ownership in the early steps:

- Government must provide the policy framework and early investment
- Industry must lead in defining use cases and demand signals
- Academia must sustain innovation and talent pipelines.

Together, this partnership can turn potential into delivery, building a national asset with global impact.

ACKNOWLEDGEMENTS

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ABOUT THE CORNERSTONE PHOTONICS INNOVATION CENTRE

The CORNERSTONE Photonics Innovation Centre is the UK's leading technology hub for silicon photonics. Our mission is to realise a continuous pipeline of silicon photonics-enabled technologies and companies that can serve a wide range of global industries by 2030. We accelerate photonic innovation by bringing together tailored start-up support, engaging networking events, expert design consultancy, and flexible prototyping, backed by our open-source silicon photonics foundry.

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