



poLight Capital Markets Day

1st June 2022



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Today's agenda

- 13:00 Welcome - Intro - Strategic direction, CEO Dr. Øyvind Isaksen
- 13:30 Market – Focus & Opportunities, VP Bus. Dev. Jon Edwards
- 14:00 Technology platform & roadmap, CTO Pierre Craen
- 14:30 Break
- 14:40 Operational setup, COO Marianne Sandal
- 15:10 Q&A session, All
- 15:30 Demo + Lab tour, R&D Lab head Dr. Lars Henriksen
- 16:15 End/snack



Dr. Øyvind Isaksen, *Chief Executive Officer*

Dr. Isaksen has been CEO of poLight since August 2014. He has previously held several CEO positions, most recently in the publicly listed company Q-Free ASA, which he left in January 2014, after 7 years as CEO. Øyvind Isaksen holds a PhD in Applied Physics.



Grethe Viksaas, *Chair of the Board, independent*

Ms. Viksaas has a long career from the Northern European managed service provider Basefarm AS. First as founder and CEO, and later as executive chair and member of the board of directors. Prior to Basefarm, Ms Viksaas served as CEO for SOL System AS and in several management positions in IT companies. She has experience from numerous board positions, including Telenor ASA. She is currently a non-executive director on the boards of Link Mobility Group Holding ASA and Crayon Group Holding ASA. She also serves as Chair of the Board in No Isolation AS and Farmforce AS. Ms Viksaas has a master's degree in computer science from the University of Oslo.

Presenting



Jon Edwards

VP of Business Development

Edwards has previously held similar roles in major camera module component companies and has spent his career in the camera module industry working for companies such as Cambridge Mechatronics, Optotune, Sony and STMicro. He holds a Degree in Electronic Engineering from the University of Edinburgh.



Pierre Craen

Chief Technology Officer

Craen is a senior executive with more than 20 years' experience in opto-mechanical systems engineering. Prior to joining poLight, he managed product development teams at Varioptic, Barco and Motorola/Symbol. Mr Craen holds an MSc in Optical Engineering from Sup-Optic, as well as an MSc in Applied Physics.



Marianne Sandal

Chief Operating Officer

Sandal is a senior executive with background from Tele-communications (Nera) and Road User Charging (Q-Free). She holds a BSc in Mechanical Engineering in addition to courses from Norwegian School of Management (BI). She has been responsible for worldwide operations for more than 15 years.



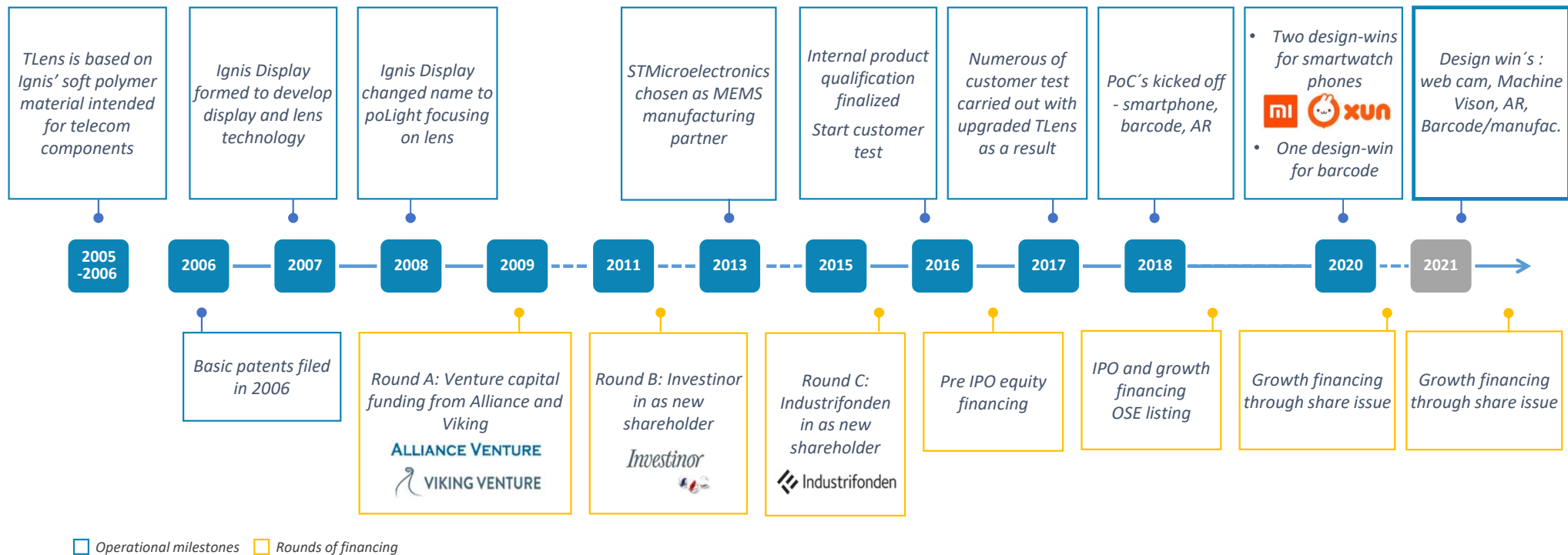
Dr. Lars Henriksen

Manager, R&D lab

Henriksen has background from SINTEF, Hydro Polymers and Ignis before poLight. He holds a Ph.D in Chemical Engineering. 20 years of experience in polymer chemistry and use of polymers in optical components.



Key milestones



poLight at a glance

Background & description

- Global player in tunable optics with applications in mobile, web cam, industrial, augmented reality, medical and others
- Founded in 2005 and has since developed state-of-the-art expertise in tunable optics, polymers, MEMS technology and image applications and processing
- Holds 17 worldwide patent families, 9 pending applications and 3 registered trademarks
- 34 employees including long-term consultants
- Headquartered in Horten, Norway, with offices in Finland, China, and employees in France, UK, USA, Taiwan and Russia.

Geographical footprint



poLight enables unique use cases



Instant focus

+



Small real estate

+



Constant field of view

+



Extremely low power consumption

TLens[®] customer-wins



poLight products & technology well-suited for several applications



Smartphones and wearables

- Large addressable market for which billions of cameras are produced for the each year
- 1,5 billion phones per year with 1 front camera and an average of 3 back cameras
- Increasing demands on both camera functionality and battery life
- Potential addressable market for TLens®/poLight technology estimated at 3 billion units per year



Barcode/Industrial

- Evolving from 1D laser to 2D imaging barcode readers
- Lasers replaced by camera systems, where autofocus will improve efficiency in scanning and portfolio
- Barcode technology is spreading to new industries
- OEM scan engine vendors today are increasingly looking to enable machine vision capabilities on their current offerings



Augmented Reality (AR)

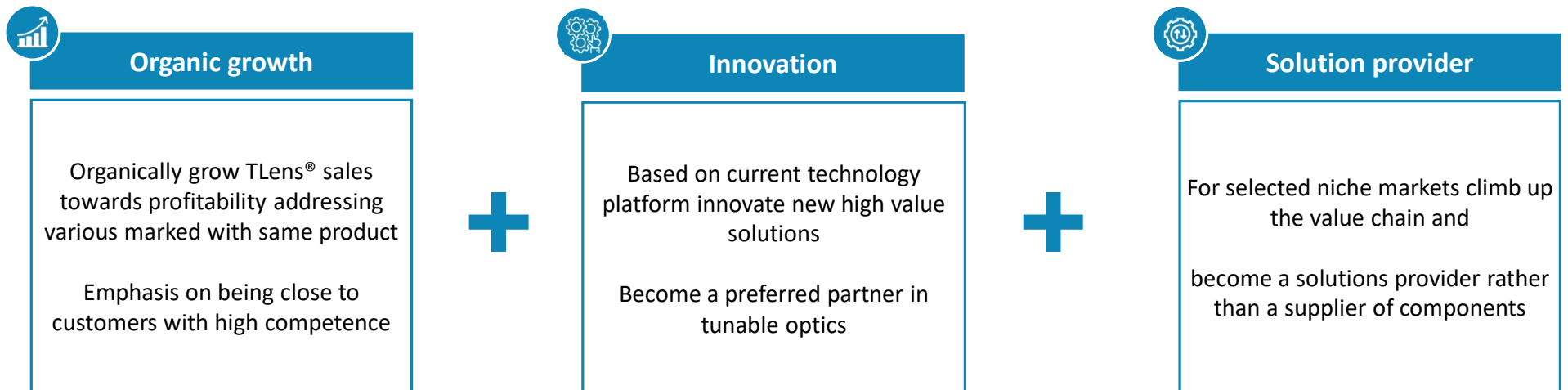
- AR is expected to grow significantly as the technology is rapidly expanding beyond entertainment and gaming to an increasing number of industrial, commercial, educational applications and later become a consumer device



Other

- New opportunities are emerging that could represent significant potential
- Video conferencing and endoscopy are just two examples of new opportunities for poLight technology

Strategic direction



poLight aims to become a preferred, technology-agnostic partner within tunable optics



Market – Focus & Opportunities

Jon Edwards, VP Business Development



poLight Global Sales and Marketing Team



Tristan Joo



Jon Edwards



Redfar Yang
(杨清发)

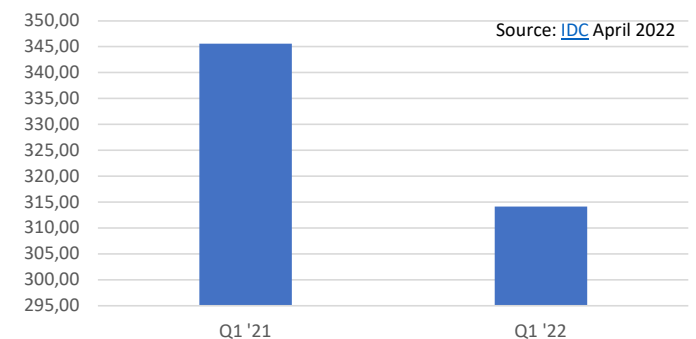
Smartphone

Short term headwinds, long term strength

- Market declined 8.9% year over year first quarter of 2022
- 3rd consecutive quarter of decline, resulting in delays to introduction of new phone models
- But, still 1.32Bn smartphones shipped in year ending Q1 2022 ([IDC](#) April 2022)
- Very low penetration of AF into front camera means almost entire market is addressable (only c. 100M front AF pcs in 2022)
- E.g. if Apple introduce front AF, we expect Android vendors to very quickly follow

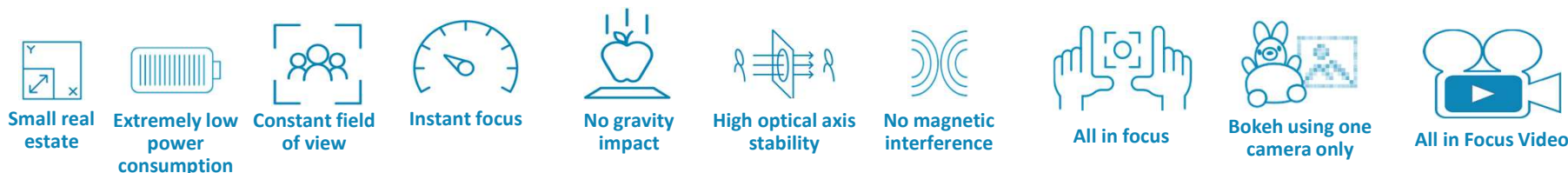
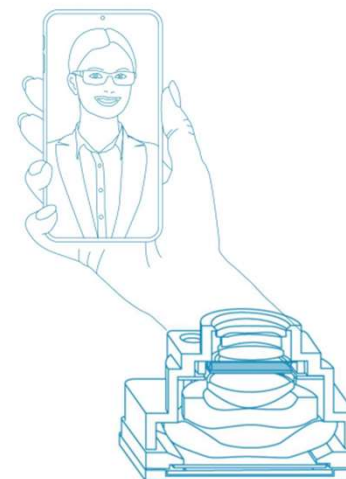


Global Smartphone shipments



Smartphone: Still the highest volume opportunity

- Technical characteristics makes TLens® and add-in design make TLens® competitive especially for front AF
 - Users like lower F# to increase brightness and create shallow DoF, necessitates AF
 - TLens® Add-in design allows smaller display “punch hole” than possible with other AF technologies
 - Non magnetic actuator enables flexible placement of cameras
 - High speed enables new applications such as All in Focus, [Light Field Capture](#)
- Back camera reference design being discussed

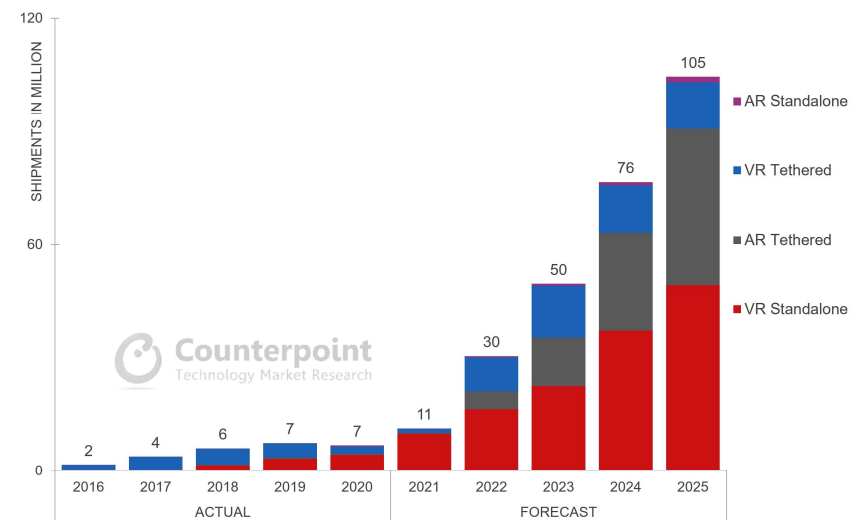


AR: Consumer use cases emerging

- Market moving from *Virtual Reality* (dominated by Oculus) to *Augmented or Mixed Reality*
- Mostly USA development activity, West Coast Companies spending heavily in R&D and acquisition
- Short term applications in professional use case for enterprise markets
- High volume consumer devices appearing around 2025
- Estimated market 100M xR devices by 2025 (Counterpoint 2021) with potential for multiple poLight devices per unit



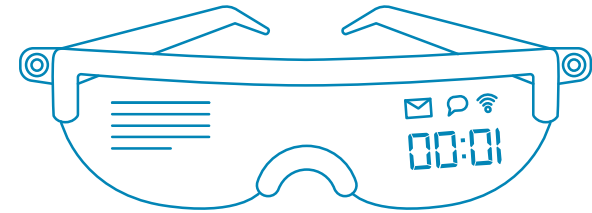
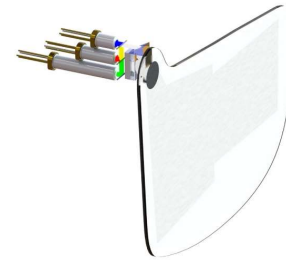
Global XR (VR/AR) Headset Forecast by Device Type, 2016 to 2025



Source: Counterpoint's Global XR (VR/AR) Forecast, Dec 2021

AR: Power and size sensitive (cont.)

- Different market dynamics from smartphone, VCM a poor match for AR, so competing against other technologies such as SMA
- poLight positioning as higher performance and lower risk alternative to competition
- TLens® is the solution to many integration problems
 - Ultra small size
 - Ultra fast speed
 - No sensitivity to gravity or acceleration
 - Power consumption (both for battery life and heat generation)
 - Athermal optics (same performance at different temperatures)
- Not just camera opportunities, projects also active for display



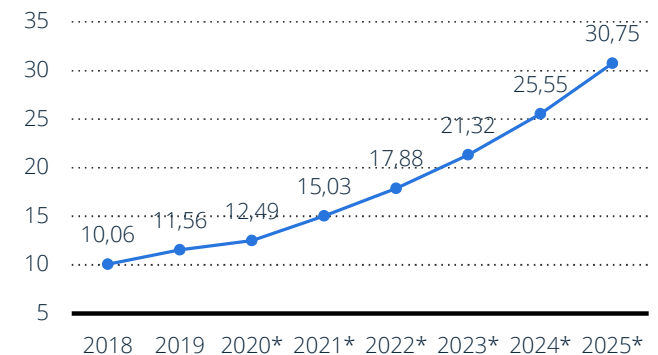
Industrial: Machine vision

- Ongoing successes in barcode, growing traction in machine vision
- High quality cameras are needed for precise interaction between computers and the physical world
- Automation and robotics (“Industry 4.0”)
- Edge computing and AI driving huge increase in demand for camera based sensing applications
- Focusing speed, insensitivity to posture and acceleration provide TLens® with a strong competitive advantage in many applications
- Some competition from VCM and other tunable lenses, often TLens® enables new applications
- Long product life cycles & less cost sensitive than consumer



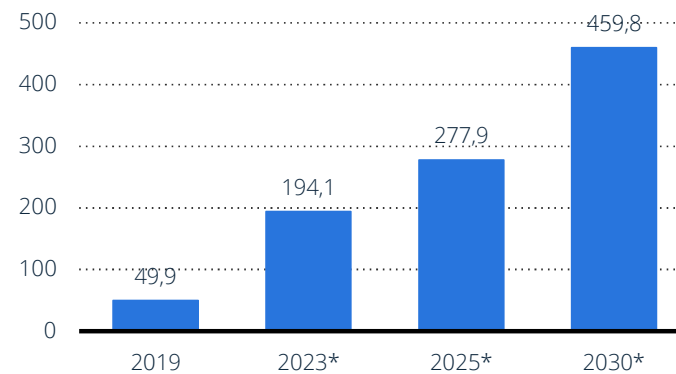
[Honeywell EX30 Scan engine](#)

Global market, edge computing \$Bn ([IOT 2020](#))

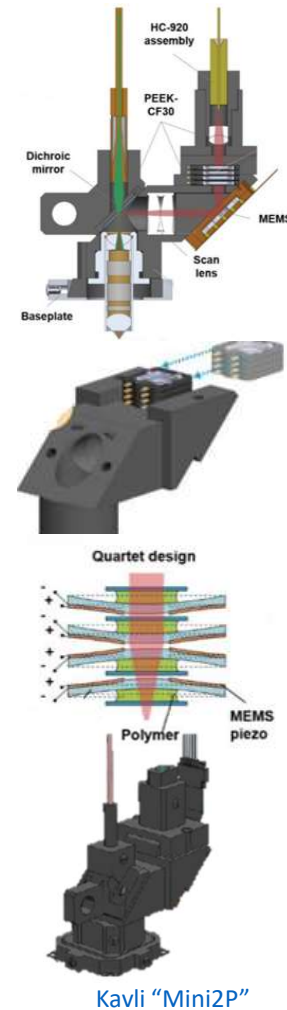


Healthcare

- COVID has accelerate the growth of telemedicine, forecast to be worth 277Bn USD by 2025 ([BRC](#))
- Robot assisted surgery and traditional endoscopy a good fit. 18M Gastro endoscopic procedures performed in US alone in 2019 (Gastroenterology 2019)
- Infection control and total cost issues driving endoscope market from reusable to single use disposable devices
- TLens® augments existing camera applications and enables potential new ones, such as single camera 3D endoscopy



Global telemedicine market size Bn USD ([BRC](#) 2020)



poLight products & technology well-suited for several applications



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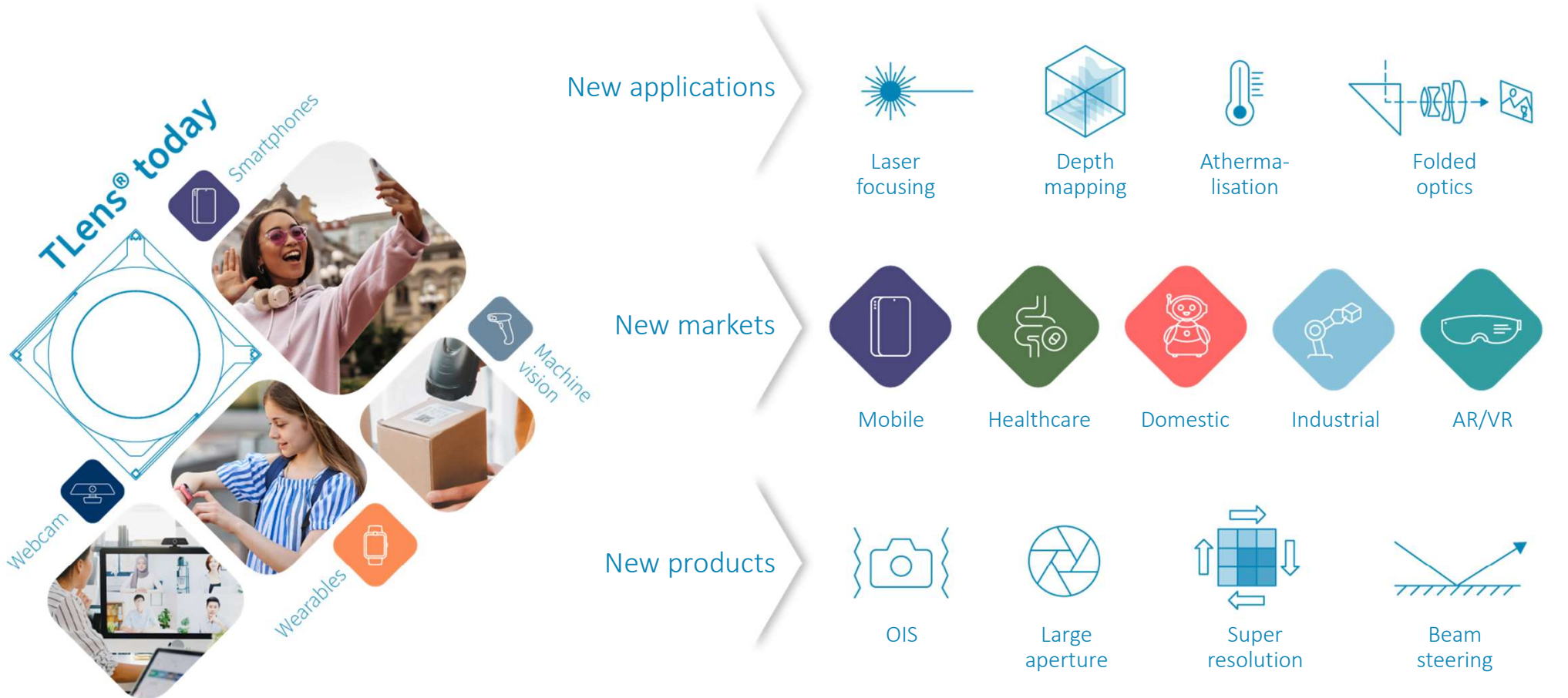
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The Future





Technology platform & roadmap

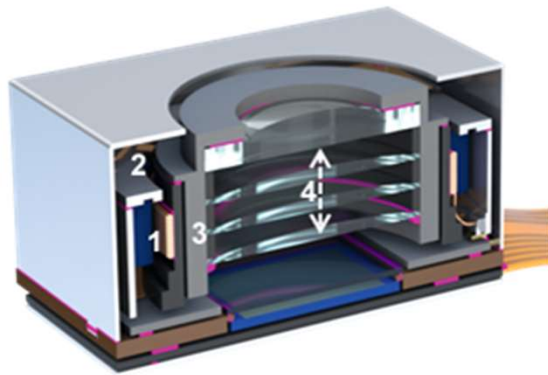
CTO, Pierre Craen



Competitive Landscape Main competitors

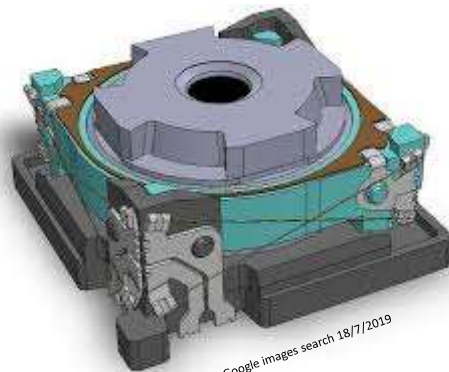
VCM

ALPS
TDK



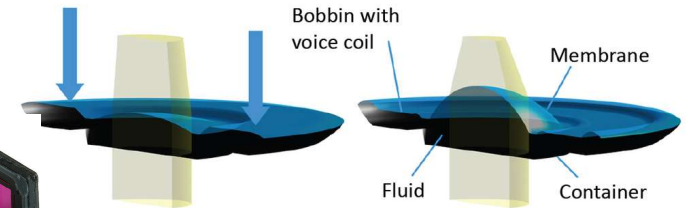
SMA
Shape Memory Alloy
Thermally activated

CAMBRIDGE
MECHATRONICS

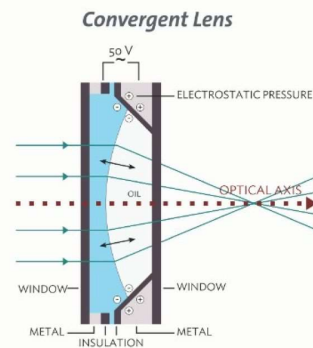
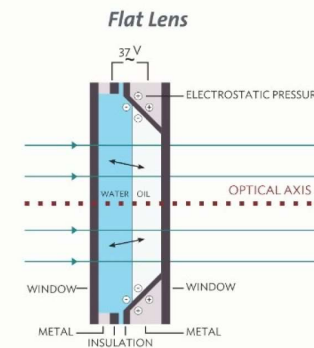
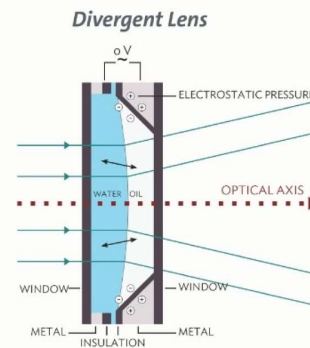


Source: Google images search 18/7/2019

Pressured liquid lens
Technology



Electrowetting - liquid lens
Technology

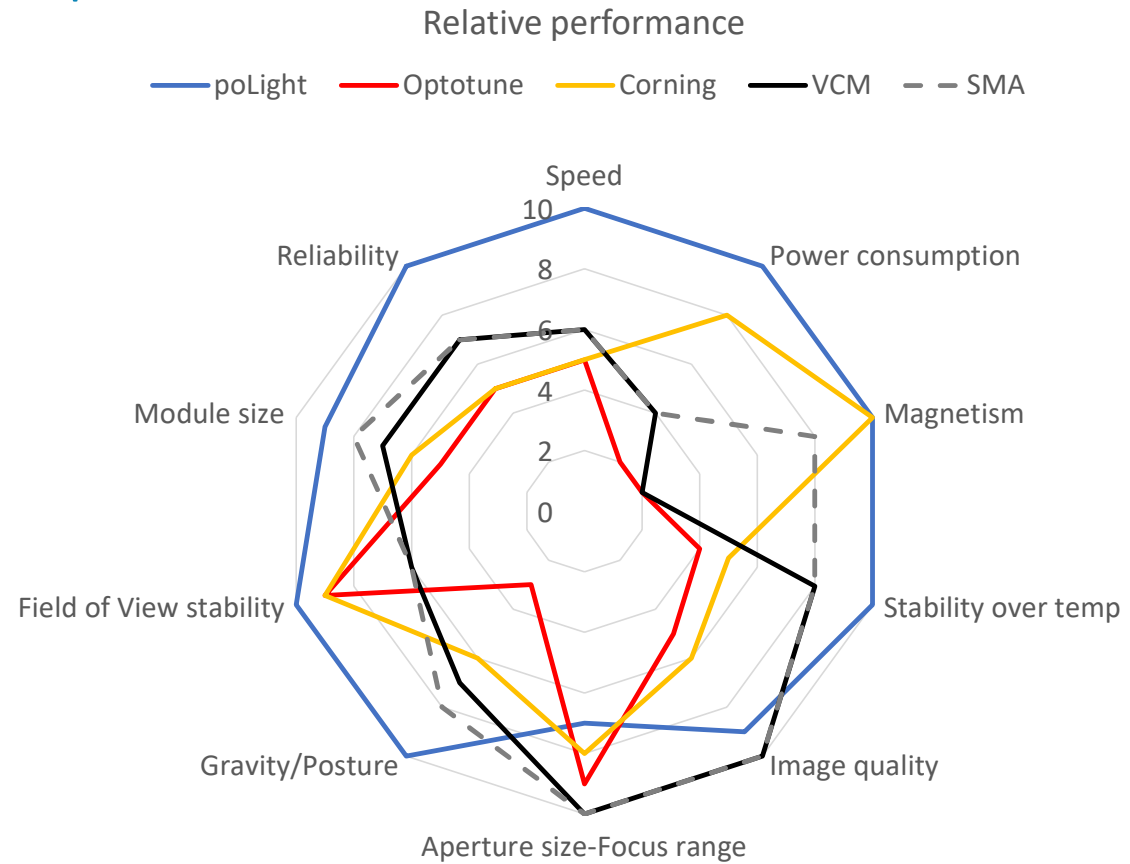


CORNING
Varioptic® Lenses

 **polight**

Competitive Landscape

Main competitors (as seen by poLight)



Competitive Landscape (others)

- Constantly monitoring other companies potentially in our space



ADLENS®



LENSVECTOR®



IP status

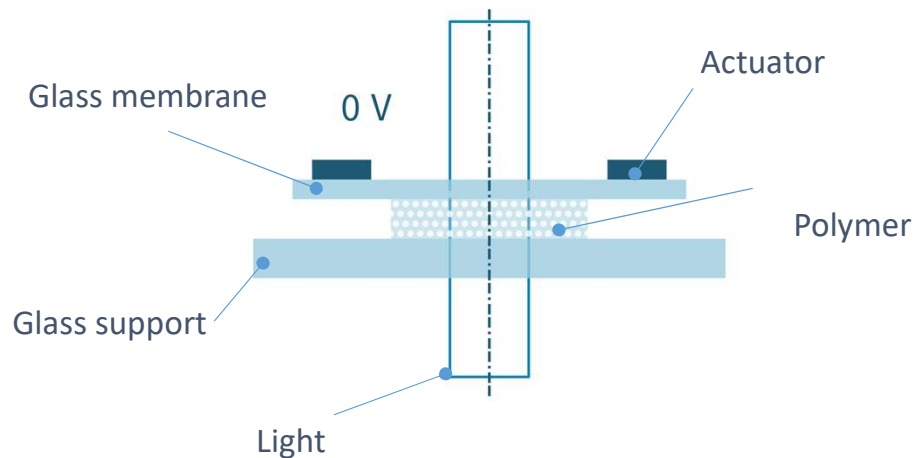
- poLight owns
 - 17 worldwide granted patent families
 - 9 pending applications
 - 3 registered trademarks
- poLight is well protected by key patents
- Important patents for the TLens® architecture valid for minimum 10 years more
- IPR strategy primary objective is to ensure that the Company and its customers can operate freely, and to avoid other companies to copy the Company's technology:
 - Continuous effort to apply for new patents to protect key features
 - Use “trade secret” for key process details.
 - Defensive application used for securing freedom to operate, when low level patentability



poLight AF Technology Platform



Current Principle of Operation



Key Feature to Support AF Roadmap

- Add in lens design - stacked TLens® (current and future product)
- ARC (Anti Reflective Coating) for further improvement
- Curved back window (glass support)
- Wavelength filtering function in back window/polymer: IR cut function
- Improved thin film PZT material and processes
- Other actuator architecture, material: bulk piezo, SMA, ...
- Pre shape deformable membrane: spherical or aspherical
- Optical material development

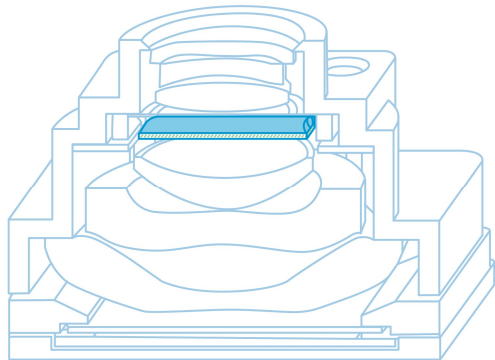
Roadmap scenario for AF products

Silver TLens [®] Silver Premium TLens [®]	Platinum TLens [®]	Small TLens [®]	Front Tuneable lens Single and double pre-shape membrane TLens [®]
 <p>3.2x3.2x0.5mm</p> <p>UAD 1.9mm UAD 1.5mm</p> <p>Up to 1/2.8 inch 64Mp Front and Back Cam</p>	 <p>3.7x3.7x0.5mm</p> <p>UAD 2.2 to 2.x mm</p> <p>Up to 1/2 inch Main Cam WFOV and Ultra WFOV</p>	 <p>2.5x2.5 x0.5mm</p> <p>UAD 1 mm</p> <p>Medical Telecom</p>	<div> <div>  <p>Fixed lens</p> </div> <p>Single pre-shape TLens[®]</p> <div>  <p>Actuator</p> <p>polymer</p> <p>Pre-shaped Membrane</p> </div> <p>Double pre-shape TLens[®]</p> </div>

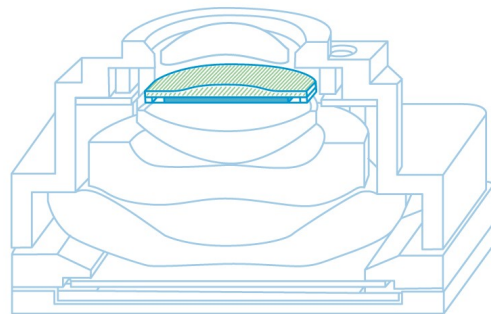
..... Today Medium Term Future Long term Future

Camera module

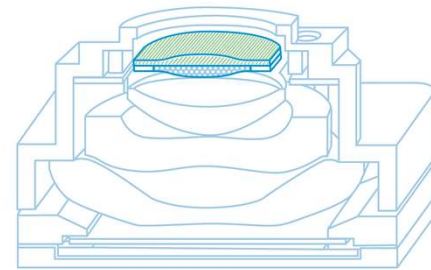
Future Roadmap scenario of poLight TLens® Integration



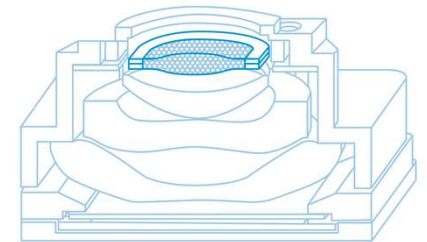
Add In TLens®



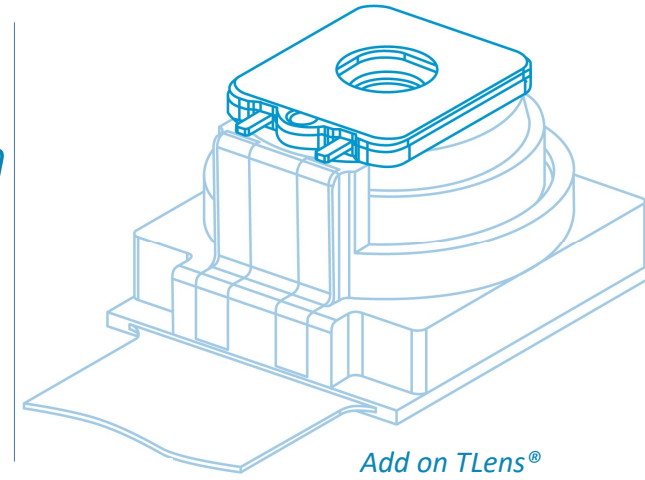
**Add In TLens®
With Curved Back Window**



**AF TLens® as first element
Pre-shape Membrane**



**AF TLens® first element
Dual Pre-shaped Membrane**



Implementing IR Cut Filter in TLens® is an option to reduce even further the thickness of the camera module and valid for any designs

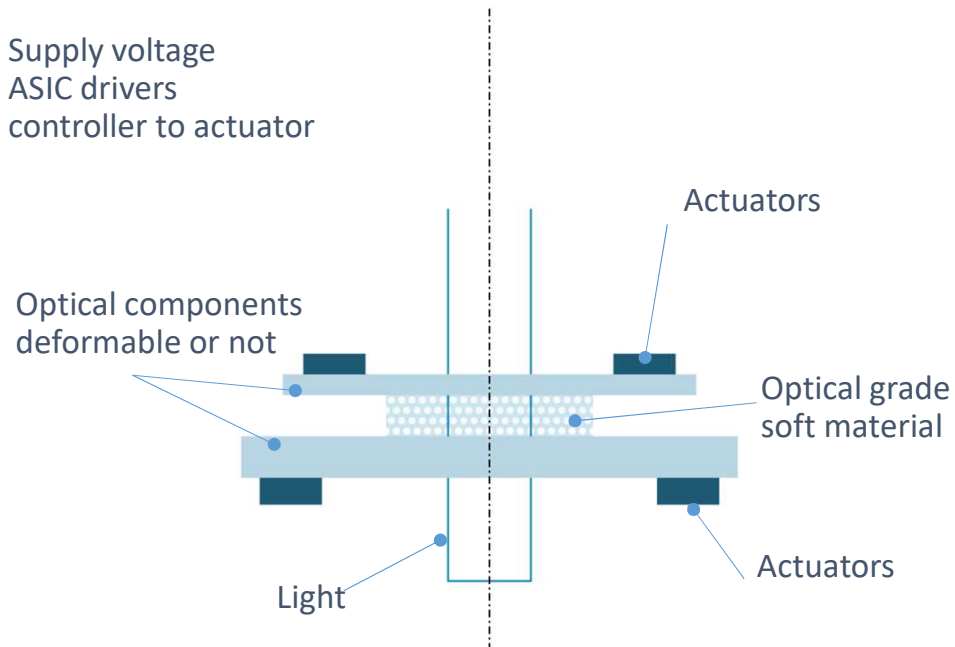
..... Near Future

..... Future



poLight® Technology Platform: The Tunable Optic

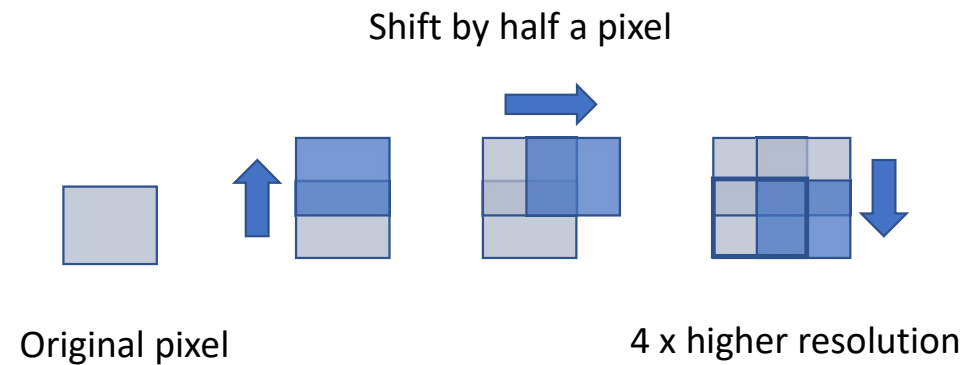
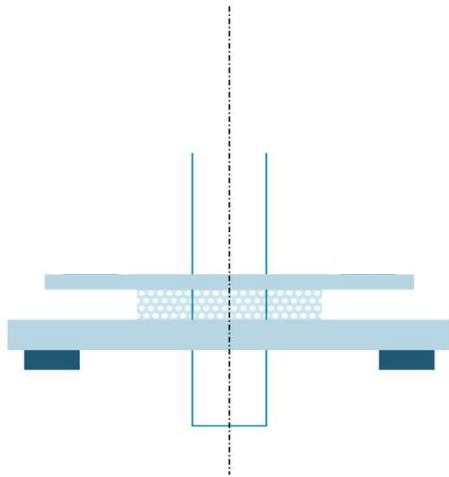
Key Technology Bricks & Principle of Operation



Present and Future Functionalities

- OIS prism or wedge
- Improved resolution wedge, beam steering
- Combination of focus & OIS
- Optical zoom tunable lens elements
- Improved thin film PZT material and processes
- Other actuator architecture, material: bulk piezo, SMA, ...
- Optical material development

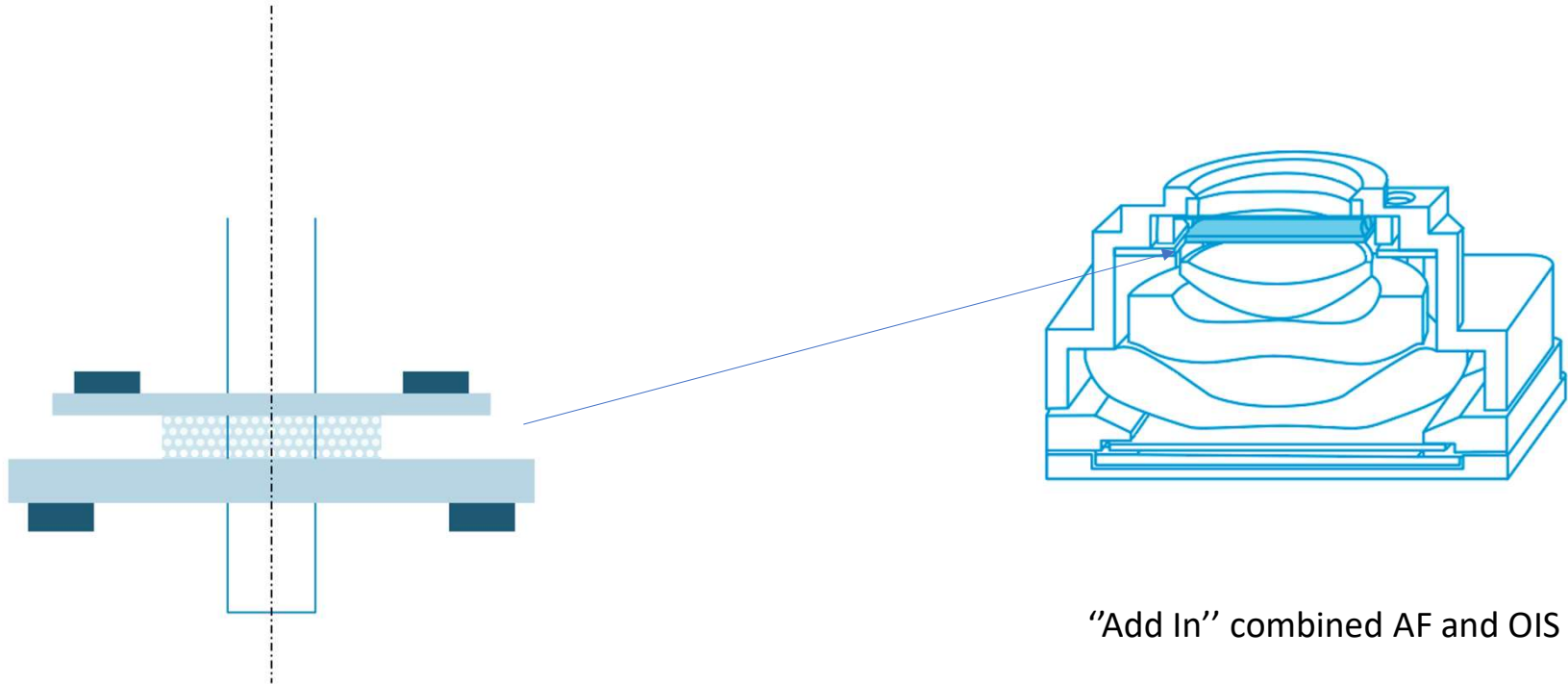
New Products Opportunities : Improved Resolution



Applications:

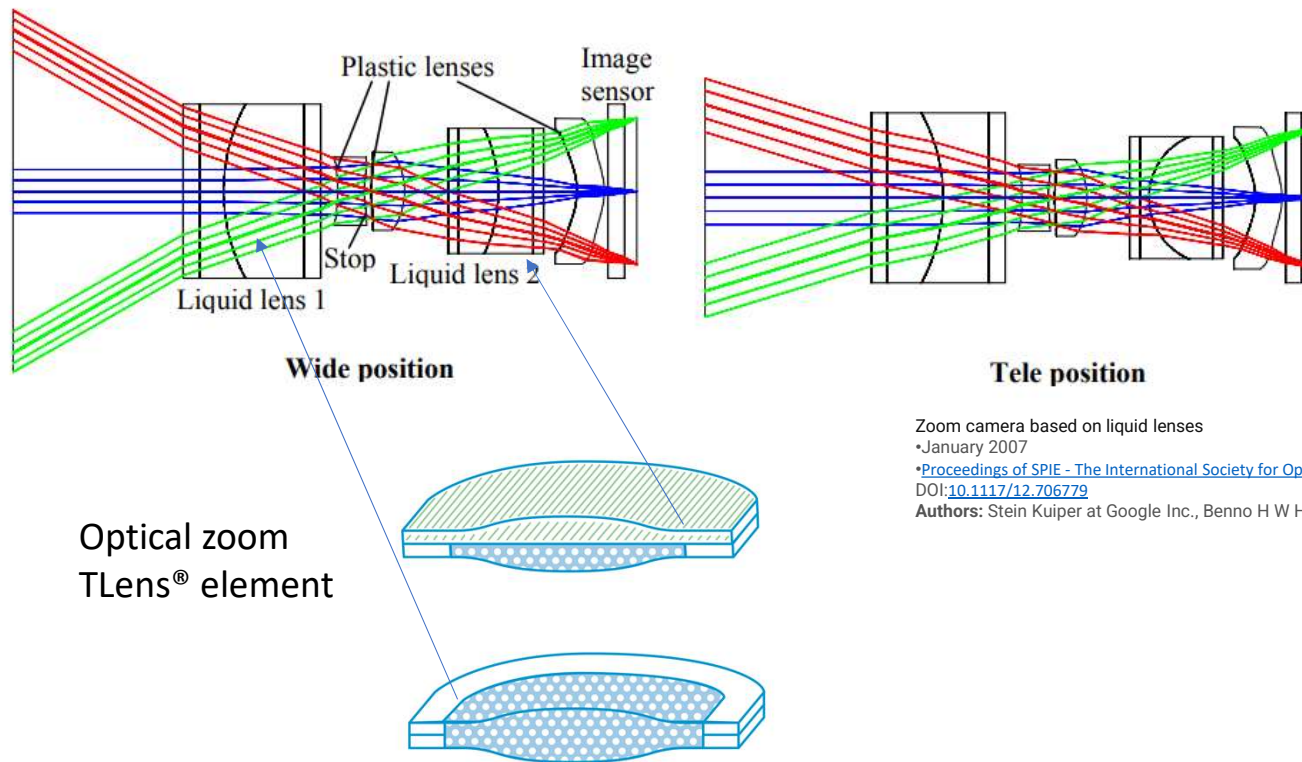
- Sensor resolution improvement
- Display resolution improvement

New Products Opportunities : OIS-AF Add in



"Add In" combined AF and OIS

New Products Opportunities: TLens® for Optical Zoom



Zoom camera based on liquid lenses

• January 2007

• [Proceedings of SPIE - The International Society for Optical Engineering](#)

DOI: [10.1117/12.706779](#)

Authors: Stein Kuiper at Google Inc., Benno H W Hendriks, J. F. Suijver at Philips



Operational Setup

COO – Marianne Sandal

poLight Operational setup

Organization/roles

- **HQ Norway (7):** Manufacturing of polymer, lab, sample deliveries, system deliveries small scale, product and data management, manufacturing technology, Head of QA, 3rd line support
- **Finland (1):** Test management
- **Italy:** MEMS wafers
- **Philippines:** Assembly, testing (under establishment)
- **Taiwan (5+2):** Supply chain management, product testing, QA, customer support, 2nd source assembly
- **China (2):** Customer support, QA
- Majority of deliveries through distributor
- **ISO9001** : Certified since 2017

Worldwide Operations

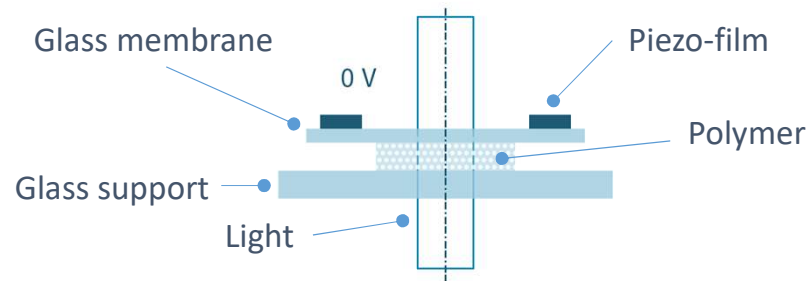


Manufacturing Capacity

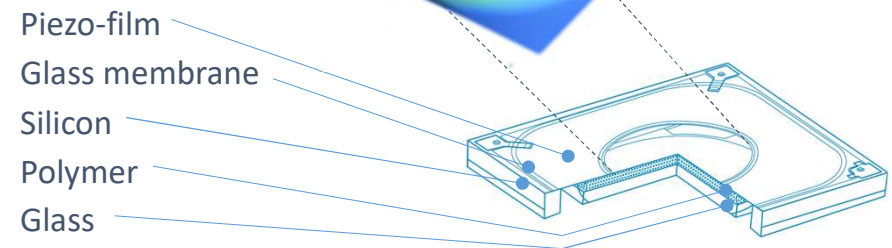
- Currently targeting installed capacity around 1.5 mill TLens[®] per month
- Material demand in production line continuously evaluated (pull in - push out) depending on market situation

TLens[®] & Supply Chain

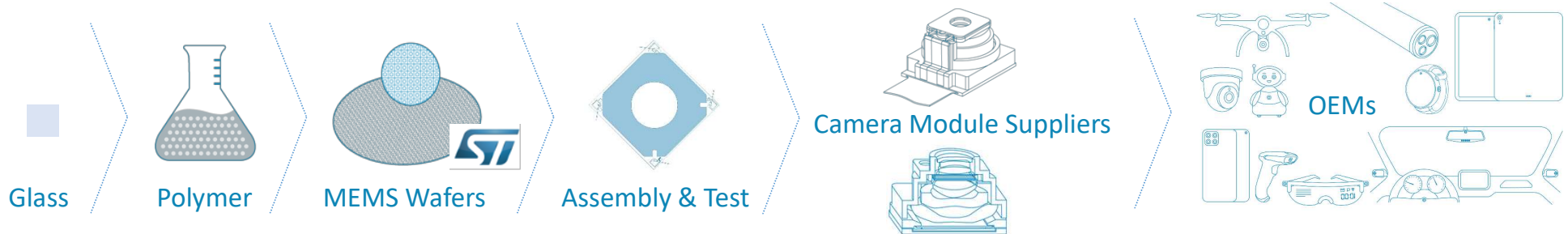
Principle of Operation



Implementation



From Gel > MEMS Wafer > TLens[®] > Camera module > OEM



Polymer

- poLight TLens® requires a polymer that is extremely soft, high optical power range, reliable, compatible with high-speed of TLens®
- The polymer used in poLight TLens® has been optimized over the last 10 years for the above parameters
- Polymer is produced at poLight HQ and shipped to manufacturing partner for TLens® assembly
- 100% testing on all critical performance parameters
- Easy to scale: 1-liter polymer cover the needs for about 1 mill TLens®
- Buffer stock kept at assembly partners (very long shelf life)
- Polymer can be fine-tuned (stiffness, response time, time of curing etc) to adapt to different customer needs



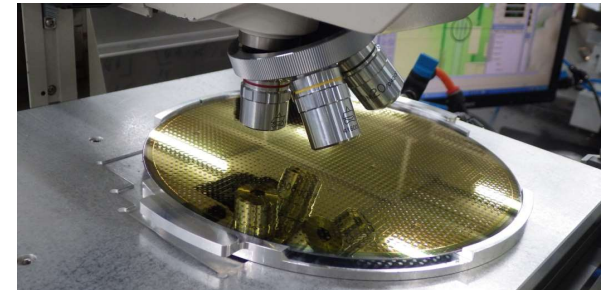
Polymer manufacturing at HQ



Syringes with polymer to be shipped to manufacturing partners

MEMS Wafers

- ST Microelectronics has been poLight's MEMS manufacturing partner since 2013
- Together we have developed an advanced optical MEMS actuator
- Core technologies being piezo material, glass membrane, stress compensation and environmental protection
- The setup is well prepared and suited for high volume operations
- Continuous improvement
- Lead-time



Assembly

- Important factors choosing assembly partner;
 - Precision pick and place suited for high volume, low cost
 - Optical quality (adds additional constraints in manufacturing)
 - Dispensing glue and polymer (small quantity, high precision, high speed)
- Theil has been poLight's assembly partner since 2013
- Today we have a fully automated production line set up in Philippines (Theil)
- poLight has qualified a second source assembly partner in Taiwan to be prepared for further ramp



TLens[®] Product Test

- Product test system for optical characterization and defect detection (include Optical, Visual Topside and Visual Bottom side)
- Currently 100% test of each TLens[®]
- All test data are transferred to poLight database for evaluation and analysis
- Full traceability of each individual part through entire supply chain



Summing Up & Going Forward

Recap status

- During the last years poLight has worked closely with several well recognized customer demanding high level of quality and reliability
- Today we supply TLens® to our customer with the best quality ever
- Our supply chain is well prepared for various ramp up scenarios

Going forward

- Yield improvement and cost optimization
- Continues improvements
- Evaluate required capacity and material securing supplies for existing and new customers



Q&A

NEXT EVENT:

Q2-22 18 August 2022



Today's agenda

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Dr. Øyvind Isaksen, *Chief Executive Officer*

Dr. Isaksen has been CEO of poLight since August 2014. He has previously held several CEO positions, most recently in the publicly listed company Q-Free ASA, which he left in January 2014, after 7 years as CEO. Øyvind Isaksen holds a PhD in Applied Physics.



Grethe Viksaas, *Chair of the Board, independent*

Ms. Viksaas has a long career from the Northern European managed service provider Basefarm AS. First as founder and CEO, and later as executive chair and member of the board of directors. Prior to Basefarm, Ms Viksaas served as CEO for SOL System AS and in several management positions in IT companies. She has experience from numerous board positions, including Telenor ASA. She is currently a non-executive director on the boards of Link Mobility Group Holding ASA and Crayon Group Holding ASA. She also serves as Chair of the Board in No Isolation AS and Farmforce AS. Ms Viksaas has a master's degree in computer science from the University of Oslo.

Presenting



Jon Edwards

VP of Business Development

Edwards has previously held similar roles in major camera module component companies and has spent his career in the camera module industry working for companies such as Cambridge Mechatronics, Optotune, Sony and STMicro. He holds a Degree in Electronic Engineering from the University of Edinburgh.



Pierre Craen

Chief Technology Officer

Craen is a senior executive with more than 20 years' experience in opto-mechanical systems engineering. Prior to joining poLight, he managed product development teams at Varioptic, Barco and Motorola/Symbol. Mr Craen holds an MSc in Optical Engineering from Sup-Optic, as well as an MSc in Applied Physics.



Marianne Sandal

Chief Operating Officer

Sandal is a senior executive with background from Tele-communications (Nera) and Road User Charging (Q-Free). She holds a BSc in Mechanical Engineering in addition to courses from Norwegian School of Management (BI). She has been responsible for worldwide operations for more than 15 years.



Dr. Lars Henriksen

Manager, R&D lab

Henriksen has background from SINTEF, Hydro Polymers and Ignis before poLight. He holds a Ph.D in Chemical Engineering. 20 years of experience in polymer chemistry and use of polymers in optical components.