INSIGHTS and Future PERSPECTIVES 2026

MED NEWS

OPTICS

MORE IMPORTANT THAN EVER

Custom Optics vs. Chip-level Camera Modules

2 Different Choices

SHOW EDITION

HIGH RESOLUTION FOR DISPOSABLE ENDOSCOPES

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Custom Optics vs. Chip-level Camera Modules

Custom Optics for Medical Devices offer a Flexible Alternative

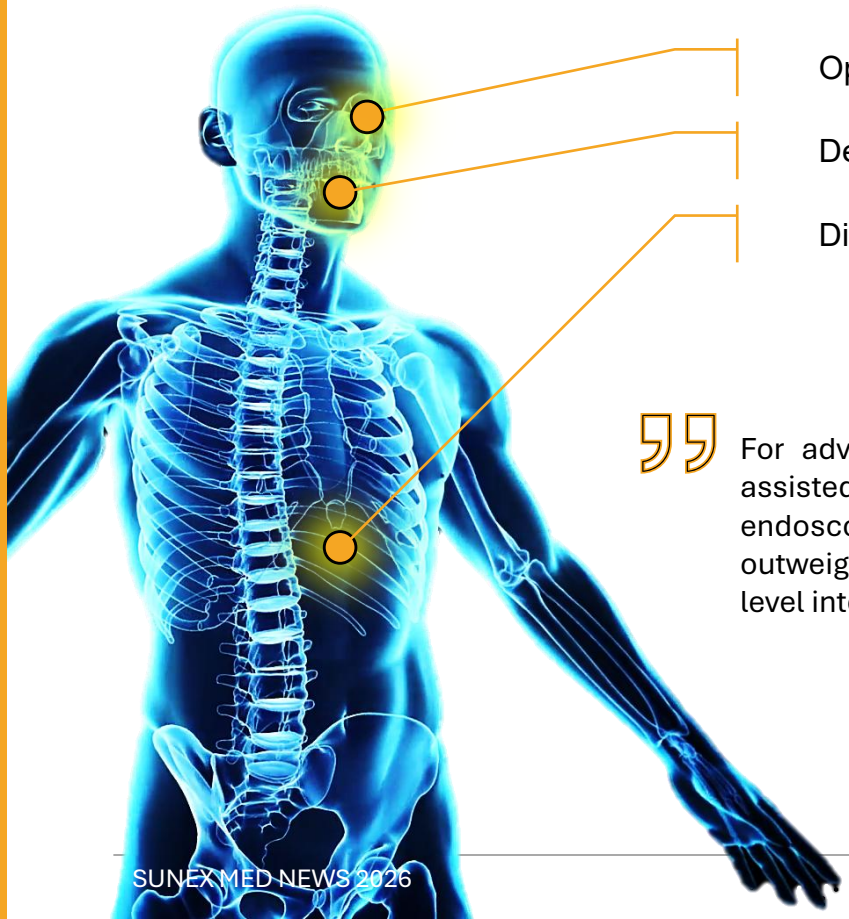
As the market for disposable endoscopes, catheter-based imaging, and minimally invasive diagnostic devices grows, medical OEMs face a key architectural decision: use a fully integrated sensor module like Omnivision's CameraCubeChip®, or pursue a custom camera system where image quality, flexibility, and system integration are optimized for the end application.

While integrated modules offer simplicity and ultra-compact size, they are not always the best fit, especially when device differentiation, superior image performance, or tight system integration is required. In these scenarios, Sunex's custom optical and sensor module solutions present a powerful alternative.

Understanding the Trade-Off: Convenience vs. Customization

Chip-level integration delivers a compact, ready-to-use module by embedding a CMOS sensor, a fixed lens, and packaging them into a single unit. This approach is well-suited to basic visualization tasks, especially where cost and simplicity dominate. However, this integration comes at the cost of flexibility:

- **Fixed optics** limit field of view, depth of field, and image plane tuning.
- **No autofocus** capability for applications with variable working distances.
- **Limited sensor options**, especially for newer sensors with specialized features (e.g., global shutter, large pixel size, or spectral sensitivity).



> For advanced medical procedures, such as robotic-assisted surgery or high-resolution disposable endoscopes, the benefits of a custom module often outweigh the convenience of a one-size-fits-all chip-level integrated solution.

Ingo Foldvari
Sunex, Director of Business Development

Sunex: Tailored Imaging Systems Designed for Performance, Size, and Cost

Sunex specializes in designing and manufacturing custom optical systems, miniature lenses, and complete camera modules for medical imaging applications, including disposable (aka single-use) endoscopes. Our expertise enables medical device companies to develop systems tailored to specific clinical tasks and imaging environments.

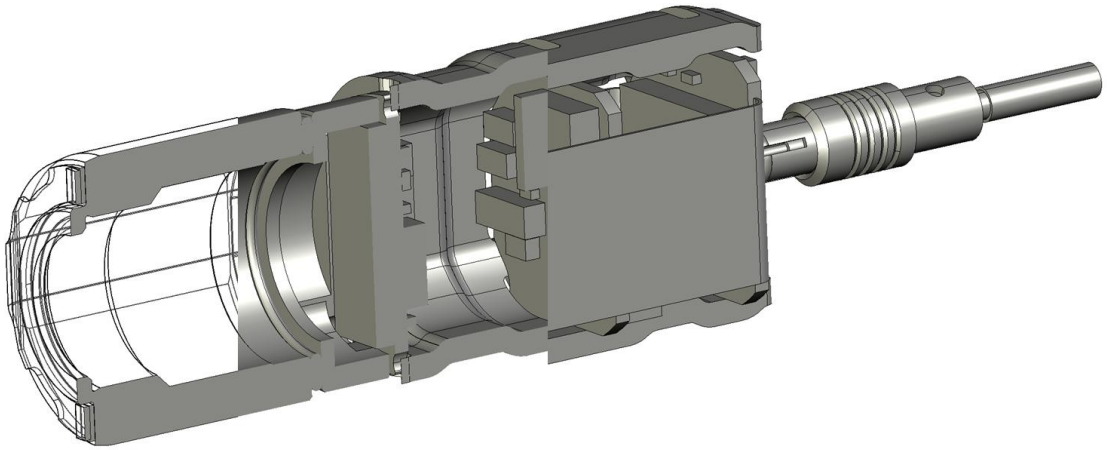
Key Advantages of Sunex's Custom Approach:

- **Application-Specific Optics**
  Custom-designed lenses to achieve your desired FOV, working distance, MTF, distortion characteristics, and mechanical envelope.
- **Tunable Autofocus Options**
  Possible integration of tunable lens elements (e.g., electrically tunable liquid lenses) enables autofocus capability in miniature imaging systems—ideal for multi-depth procedures or variable tissue distances.
- **Sensor & PCB Flexibility**
  Support for any CMOS sensor of your choice—no lock-in to predefined imaging specs.
- Sunex also offers custom PCB design and manufacturing, including image sensor integration for bare die and packaged CMOS sensors, power delivery, and connectivity.
- **Advanced Optical Alignment**
  Active alignment between the lens and sensor ensures optimal focus, centering, angular performance, and the smallest part-to-part variance, which is particularly critical for small-pixel sensors, high-resolution systems, and large-volume applications.
- **Feasibility Studies & System Optimization**
  Early-stage design feasibility services, optical simulations, and system-level analysis help de-risk development and accelerate product timelines.
- **Sterilization-Ready Materials**
  Lens and housing materials are selected in accordance with the customer's requirements for sterilization and approval processes commonly used for single-use medical devices.
- **Scalable Manufacturing**
  Whether you need prototypes for clinical trials or full-scale production for disposable scope lines, Sunex's vertically integrated capabilities can scale with your business from early prototypes to high-volume series production.

Use Cases That Benefit from a Custom Approach

There are many different indications, devices, and procedures in the medical field. Even though they all have their specific requirements, they all benefit from a custom approach to the optical system if one or more of the following are required:

- High-resolution and wide-angle disposable endoscopes requiring low distortion and superior edge-to-edge sharpness.
- Large Depth-of-Field (DOF) imaging where autofocus is needed to maintain clarity at variable object distances.
- Dual-imager or Stereo vision systems, where precise calibration and alignment between channels are mandatory.
- Low-light or IR-capable applications requiring optimized optics and sensor pairing.



Sunex MOD124 Hybrid Disposable Endoscope Module Lens

Conclusion: Choosing the Right Imaging Architecture

Fully integrated chip-level camera modules provide a valuable solution for many basic disposable imaging tasks, especially where space and cost constraints are paramount.

However, when performance matters, whether it's higher image quality, autofocus capability, robustness, or system-specific sensor selection, a custom camera module built by Sunex offers differentiation by meeting the performance, size, and commercial objectives required to make the end-customer successful in their domain.

From lens design and simulation to sensor integration, active alignment, tunable focus implementation, and custom PCB layout, Sunex provides a comprehensive pathway from concept to volume production, delivering imaging systems that meet the demands of next-generation medical devices.

Sunex

Scan the QR code to access product datasheets, case studies, incl. a Design Guideline, and more.