



- 1 Schematic optical design.
- 2 Size comparison multi aperture camera head, Euro cent.
- 3 Camera image after real-time image processing.

Fraunhofer Institute for Applied Optics and Precision Engineering IOF

Albert-Einstein-Straße 7
07745 Jena

Director
Prof. Dr. Andreas Tünnermann

Head of Business Unit Optical Components and Systems
Prof. Dr. Uwe Zeitner

Contact
Dr. Robert Brüning
Phone +49 3641 807-360
robert.bruening@iof.fraunhofer.de

www.iof.fraunhofer.de

MULTI APERTURE CAMERA-OPTICS ON WAFER-LEVEL

Technical Concept

- Array of miniaturized cameras using a microlens array on image sensor (CMOS)
- Each microlens images different part of field of view
- Pitch difference enables different viewing directions of each optical channel
- Partial image stitching by electronic image processing
- Channel-wise adapted microlenses for correction of aberrations
- Optical isolation of channels for the suppression of optical crosstalk

Exemplary Parameters

- | | |
|----------------------|-------------------|
| ▪ Total track length | 1.4 mm |
| ▪ Image resolution | 700 x 550 Pixel |
| ▪ Microlens diameter | 375 μm |
| ▪ F-number (F/#) | 3.7 |
| ▪ Field of view | 58° x 46° |
| ▪ Pixel pitch | 3.2 μm |

Wafer-Scale Technology

- Origination of lens arrays by reflow of photo-resist or laser lithography
- Structuring of aperture arrays on thin glass substrate (lithography)
- Wafer stacking and bonding
- UV-molding of lens arrays in UV polymer
- Dicing and assembly with CMOS imager

Our Offer

- Optical design, prototyping and characterization of microoptical imaging systems for custom-specific applications
- Provide imaging solutions for tightest working spaces

Typical Applications

- Consumer electronics
- Machine vision
- Sensors (e.g. Automotive)
- Security and surveillance