

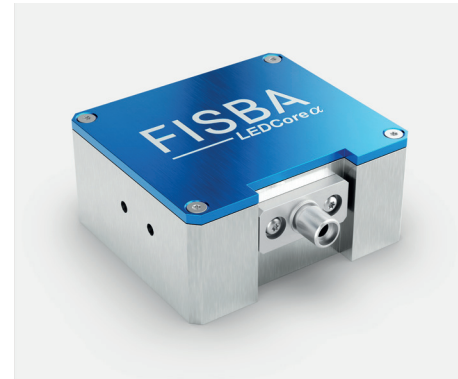
# White Light Sources

## Serving high brightness needs

White Light Sources for a wide range of applications.

### Your Benefits

- **Customized to your application:** Experienced in development of several white light source technologies adapted to customers needs.
- **Single partner:** Endoscope or optical system developed together with the illumination from a single source.
- **Operational excellence:** Assembly technologies for highest efficiency from adhesive bonding to alignment.



RGB LED Combiner

### Technology Expertise

- Wide variety of illumination technologies ensures best match for customers application
- RGB LED combining and fiber coupling for variable color temperature and high color rendering index, on request with closed-loop color control
- Laser Pumped Phosphor for applications with very thin fibers
  - Partial or full conversion
  - Static or dynamic phosphor
- Direct coupling of a High Power White Light LED into an optical fiber for low-cost applications with small footprint
- Integration of multiple wavelengths into the beam path



High Power White Light LED



### Applications

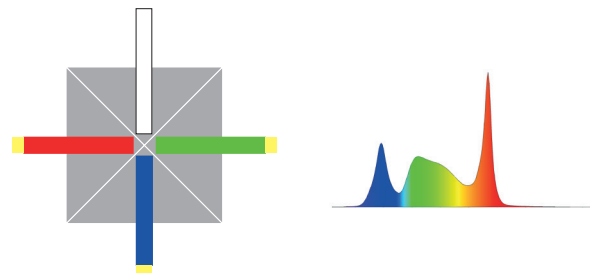
- Machine Vision
- Eye Surgery
- Surgery Microscopes
- Confocal Microscopy
- Endoscopy

# White Light Sources

## 3 different principles

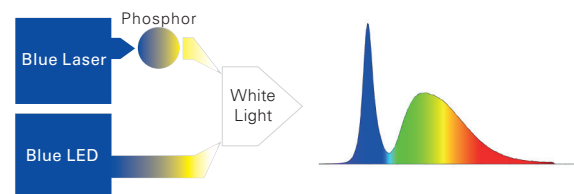
### RGB LED Combiner

Fiber type	d = 1000 $\mu$ m / NA 0.5
Typical luminous flux into fiber [lm]	> 100
Possible dimensions mm (L x W x D)	45 x 50 x 25 mm
Advantages	- variable color coordinate - high color rendering index



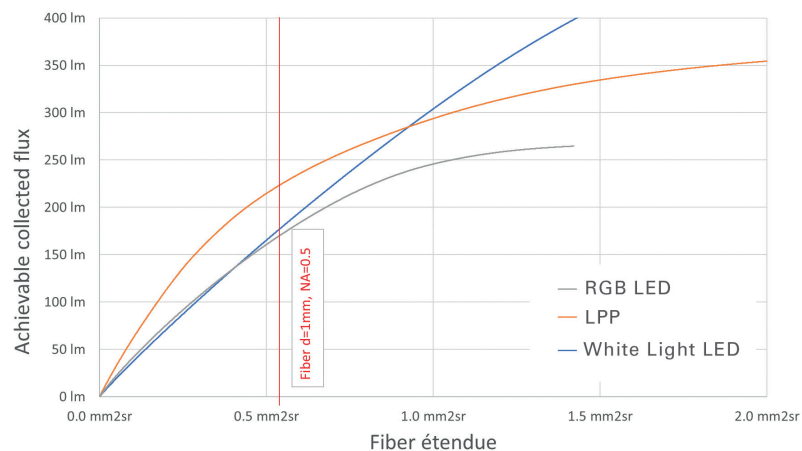
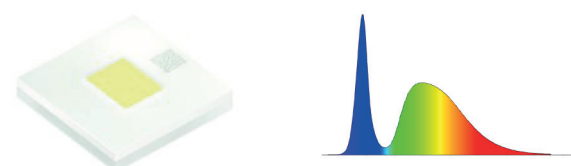
### Laser Pumped Phosphor

Fiber type	d = 200 to 1000 $\mu$ m / NA 0.5
Typical luminous flux into fiber [lm]	160 @ 1000 $\mu$ m
Possible dimensions mm (L x W x D)	50 x 50 x 50 mm
Advantages	- rather fixed color coordinate, some minor influence if blue LED light is added - higher luminance than white LED



### High Power White Light LED

Fiber type	d = 1000 $\mu$ m / NA 0.5
Typical luminous flux into fiber [lm]	120
Possible dimensions mm (L x W x D)	25 x 20 x 16 mm
Advantages	- based on single high power white LED - fiber-scoupled module - smallest footprint



The fiber étendue describes the ability of a system to collect light. This is strongly dependent from the source. The diagram clearly shows that the Laser Pumped Phosphor (LPP) has its biggest advantages when using fibers with a small diameter.