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Illumination Challenges in Non-Industrial Vision Applications

Simon Stanley
Managing Director
ProPhotonix IRL Ltd

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Making Light Work For You

ProPhotonix designs and manufactures high-quality LED systems and laser modules for the industrial, medical and security markets





Agenda

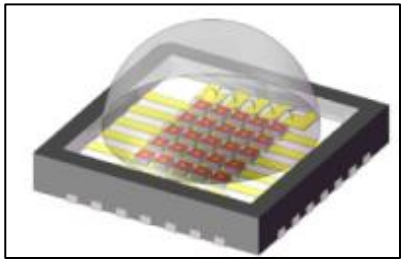
- Illumination Challenges in non-Industrial imaging
- LED Technology
- Application Examples

Overview of Non-industrial vision applications

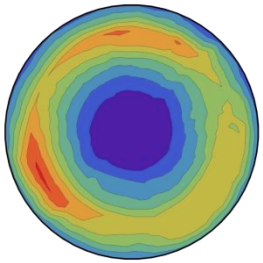
- Vast array of non-industrial vision applications and market is growing
- Some markets e.g Security & Transport are more mature than others
- Medical is an emerging market with the range of applications expanding rapidly
- The medical market is following the trend of industrial vision in that traditional technologies are being replaced by LED technology
- LED technology is enabling advances in Medical technology

Illumination Challenges

Form Factor

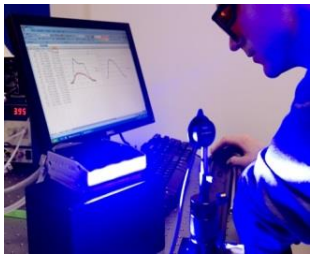


Cost considerations



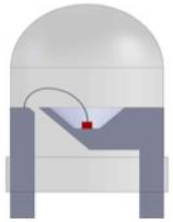
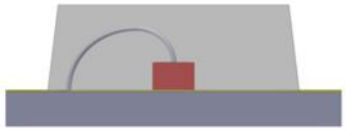
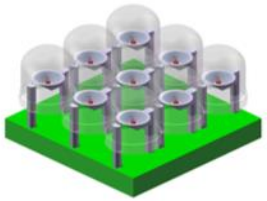
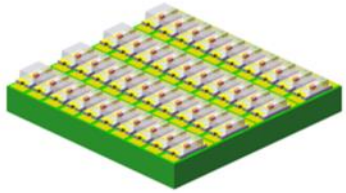
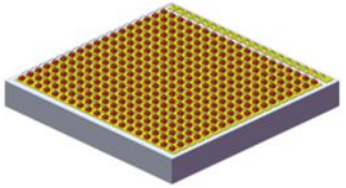
Uniformity

Wavelength Optimization



Intensity

LED Packaging Technologies

LED type	T-Pack	Surface mount	Chip on board
Device image			
Packed array (10mm x10mm)			
Density	9 LEDs	40 LEDs	342 LEDs
Array Power	0.4 Watts	4 Watts	68 Watts

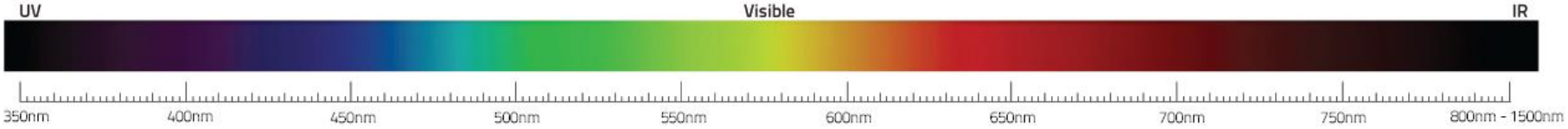
Advantages of COB LED technology:

- Compactness
- Uniformity
- Intensity
- Thermal Management

Form factor

- Good Illumination is the key to a successful vision system
- Without the correct form factor, illumination cannot be optimized
- For medical applications the trend is towards miniaturization
- Chip on Board LED technology provides a significant advantage in creating compact form factors as the product design starts with the most compact array of LEDs.
- ProPhotonix product designs have enabled more compact systems

Wavelength Optimisation

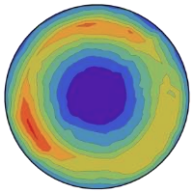


- The optimum wavelength increases image contrast and improves the overall system performance

- Chip-on-Board LED technology allows for any available wavelength or multiple wavelengths to be utilized

"ProPhotonix is the first company that I think of when I need a specific wavelength"
Stephen, Research Scientist Owens Illinois

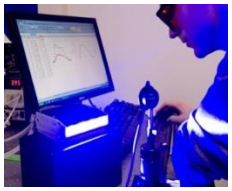
Uniformity



- Uniform light is extremely important in vision systems.
- If the light is not uniform, it is more difficult for the system to identify defects in the target material, as the non-uniform light will result in reduced contrast.
- Higher packing density of the LED chips result in more uniform light with a reduced requirement for diffusers, which have the disadvantage of reducing intensity.

"The result was an order of magnitude improvement in the image quality"
David Gruebele, Evena Medical

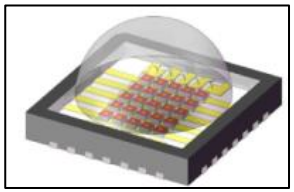
Intensity



- In the vast majority of applications, the higher the intensity, the better
- In medical applications, the challenge is often to deliver the high intensity required from a very compact form factor.
- Chip-on-board technology is ideal for these applications due to the ability to densely pack LED chips
- Thermal management is also a key consideration

"More Light, More Light, More Light….."

Cost Considerations



- Although a custom lighting solution may seem like a more expensive option, a customized solution will deliver cost savings as it will deliver superior system performance

- After initial set up costs, products manufactured in volume deliver superior value

"After an initial investment we were able to achieve our production cost goals....."

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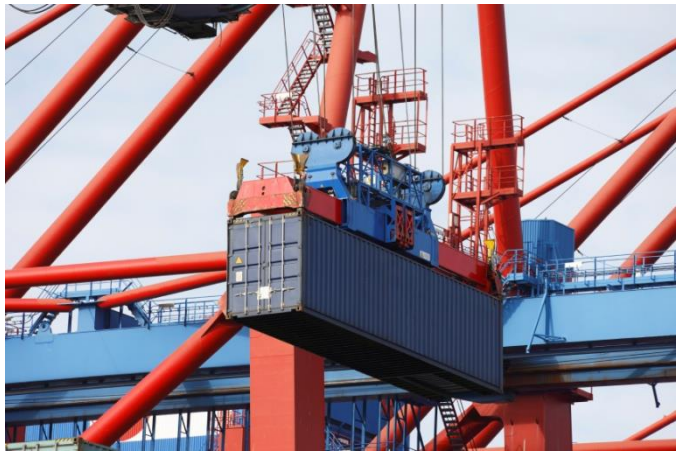
Applications

Security & Transport Applications

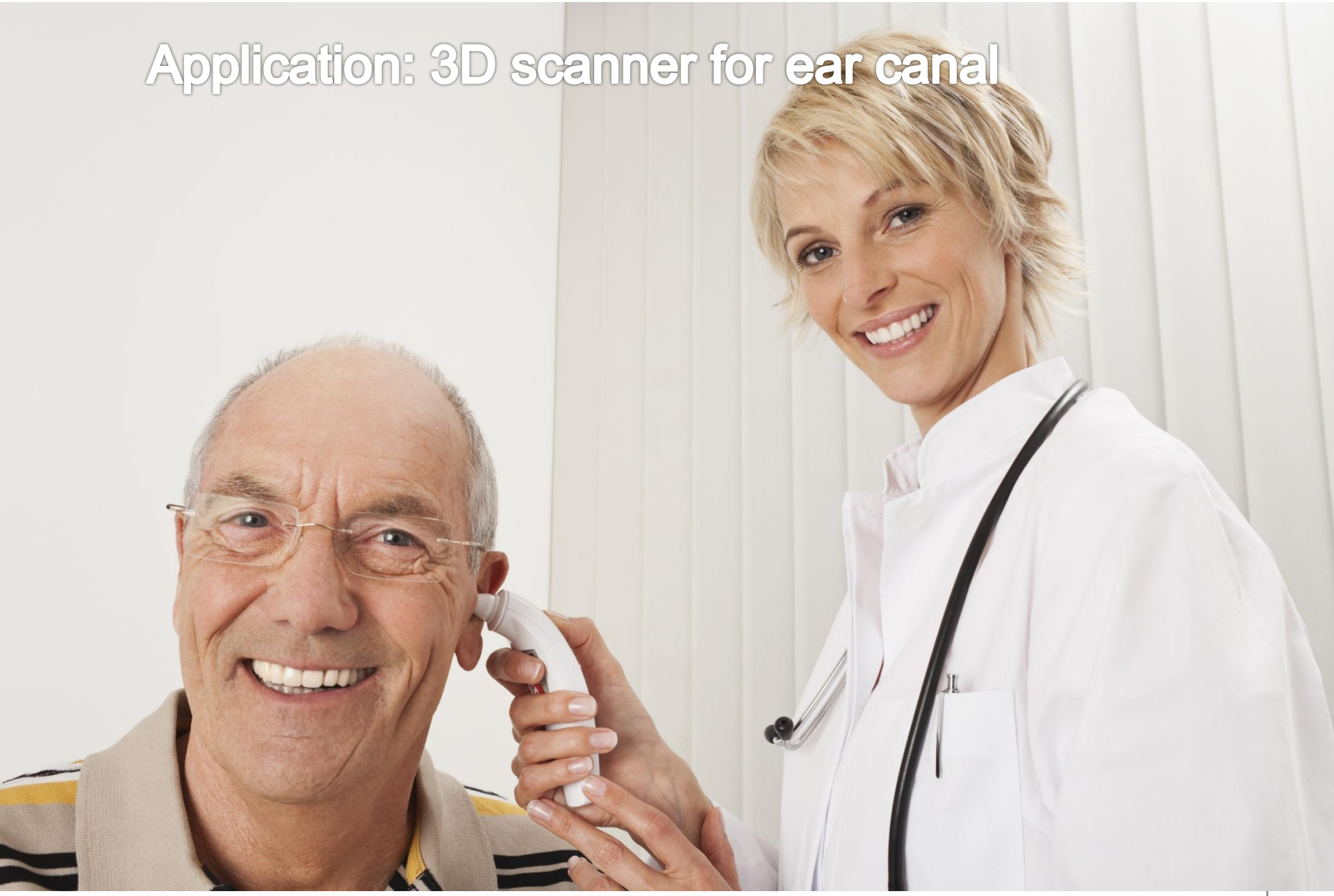
- Application: ANPR/ ALPR
- IR imaging Application
- Challenges:
  - Long working distance
  - Eye Safety
  - Environmental conditions
  - Form Factor
- Solution:
  - Compact high intensity IR spot light

Security & Transport Applications

- Application: Container Inspection
  - OCR (Identifying Marks)
  - Inspection for damage
- Line scan Application
- Challenges:
  - Long stand off distance
  - Length requirement
  - Environmental conditions
- Solution:
  - IP rated, high intensity, modular LED Line Light



Application: 3D scanner for ear canal



Application: 3D scanner for ear canal

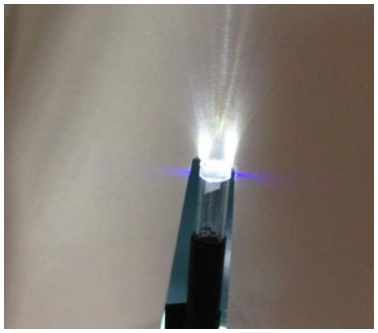
Requirements: Lighting over a larger field of coverage at distal end of probe

Challenges

- Limited footprint for LEDs versus intensity requirement
- Glass tube - conductivity vs optical efficiency trade-off

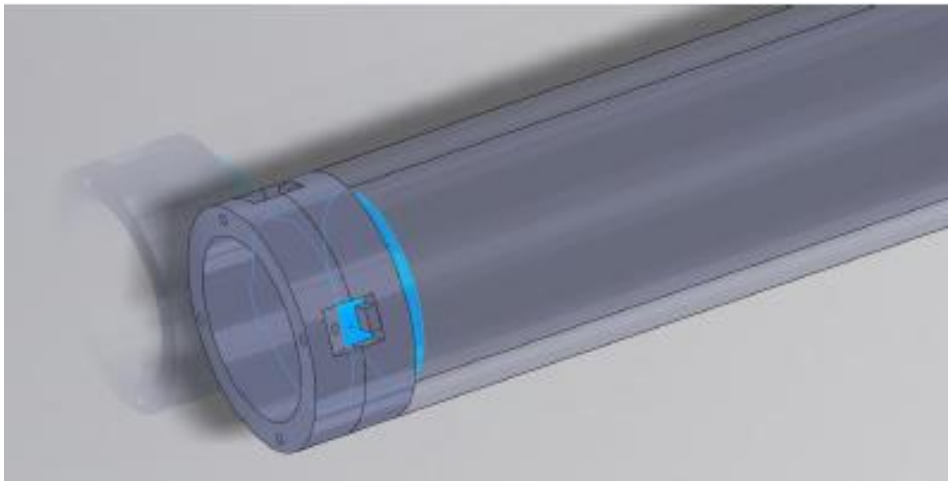
Solution

- Used 290µm square Blue LEDs coated with phosphor
- Ceramic substrate (walls only 0.3mm thick, inner diameter 2.5mm, outer diameter 3.15mm)



Prototype

Application: 3D scanner for ear canal



Endoscope Light Source Case Study

Endoscope Light Source Case Study

Requirements

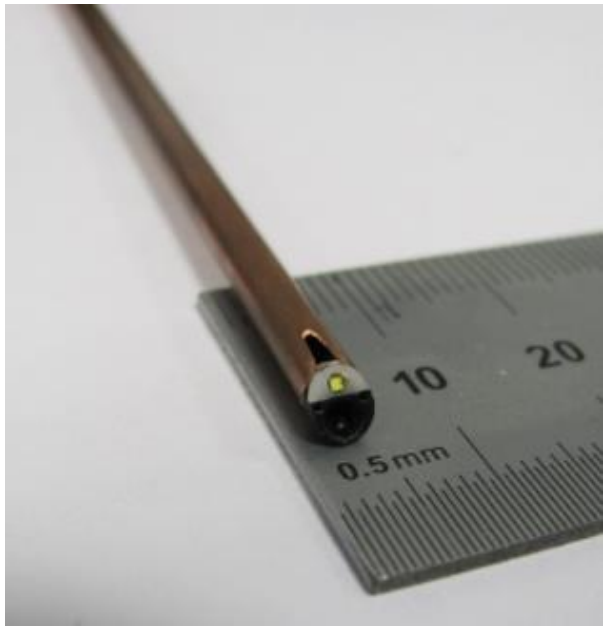
- LED light source for Disposable Endoscope
- Light intensity must equal what can be achieved with current technology (fibre bundle)

Challenges

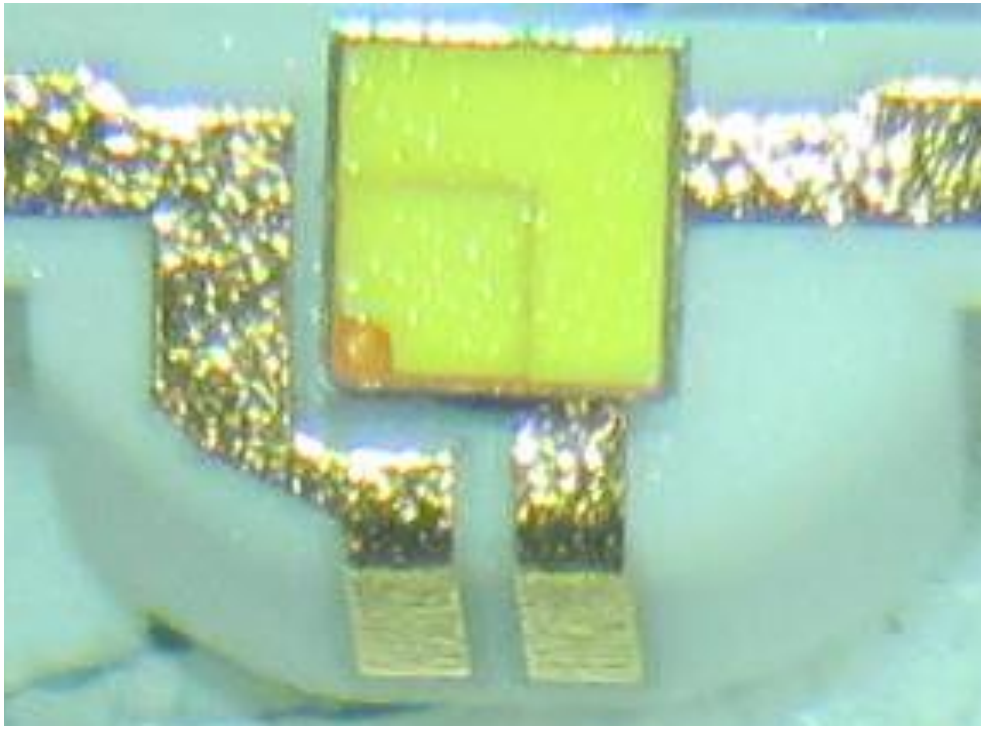
- Thermal issues: Max temperature rise of any part in contact with the body is 5°F (2.78°C)
- Size constraint: Assembled in 4mm tube
- Expected Volume production: 10,000's per annum

Solution

- Three-dimensional injection moulded ceramic substrate
- Custom laser patterning of interconnects on ceramic
- Single White 700µm^2 LED



Endoscope Light Source Case Study



Application: Dental Ring Light

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3D dental scanning & imaging

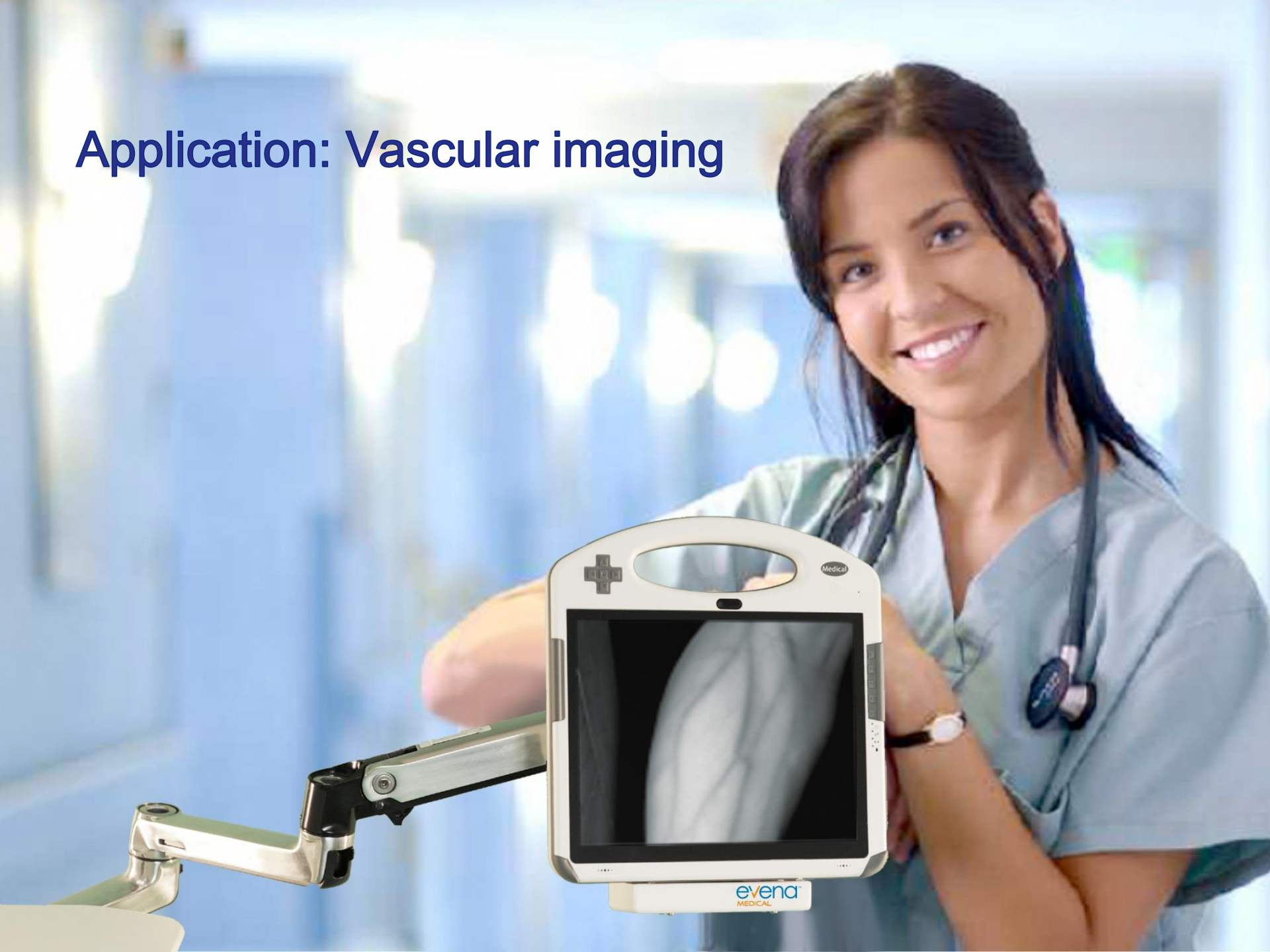
- Product
  Custom LED ring light (192 LEDs)

- Requirement
  Company needed compact, bright, waterproof light source to fit on the end of a hand-held device

- Strength
  Ability to overcome the design challenges associated with fitting 192 LEDs into an annular shape with 12mm dia.

Application: Dental Ring Light

Application: Vascular imaging



Application: Vascular imaging

- Application: imaging deoxygenated blood in veins to identify vein location
- Correct wavelength selection led to a significant improvement in the effectiveness of the overall system
- Form factor & intensity were also a key issues

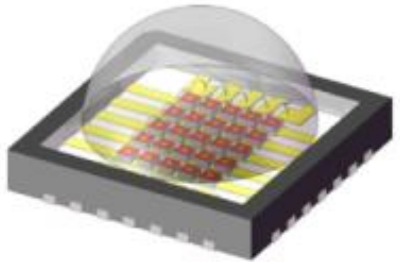
Application: Eye Tracking Illumination

Application: Eye Tracking Illumination

- Illumination Source for
  Eye-tracking sensor

- Product
  Addressable IR LED array
  100 LEDs in an area 78.9mm^2

- Form Factor & cost were critical in this application



For More information:

Contact us at:
sales@prophotonix.com