MATERIALS THAT MATTER

VCSELs for mobile applications- Which attributes?

EPIC Online Technology Meeting on VCSEL Technology and Applications

29th May 2020

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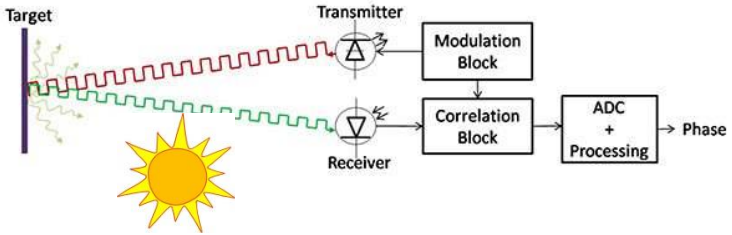
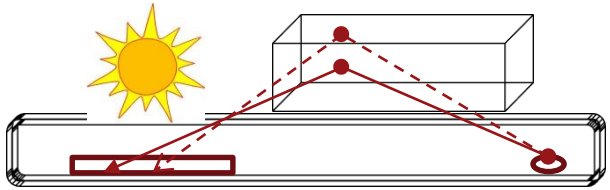
Technologies for 3D mapping

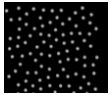
- **Time based: Time of Flight**



- **Applications: world facing (AR, Boke, Auto Focus, virtual shopping)**
- **Two methods to extract depth**
  - Direct TOF (1cm=67ps): Fast modulation, Fast detectors
  - Indirect (CW TOF): e.g. sine Modulation (phase shift)
- **Pros / Cons**
  - **Simple SW**
  - **No parallax required (compact)**
  - **Noise increases linearly with depth**
  - **Dedicated pixel technology**
  - **Lower spatial resolution**

- **Triangulation: Structured light / Stereo**





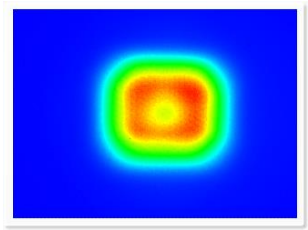
- **Applications: front facing (face unlock, mobile payment)**
- **Parallax transforms depth difference into lateral image displacement**
  - Stereoscopic
  - Structured Light
- **Pros / Cons**
  - **"Standard" CMOS image sensors**
  - **Good depth resolution**
  - **Requires robust mechanical platform**
  - **Stringent reliability requirements**
  - **Depth noise increases with distance^2**

Illumination system desirable attributes

Size

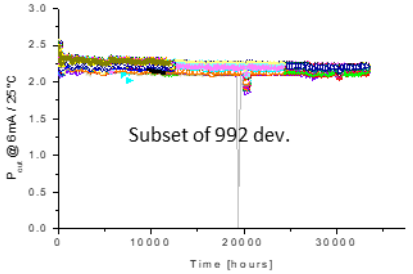
Eye Safety

Cost



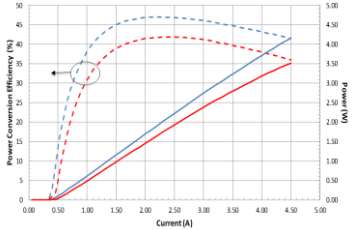
Beam Shaping

Reliability

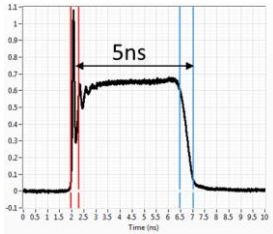


Power Efficiency

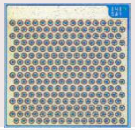
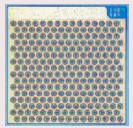
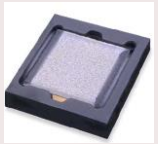
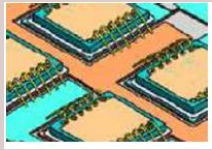
Modulation speed



EMI



The right VCSEL for the application

Application	Power levels	Wavelength	Other Characteristics	Pictures
Display Navigation	<1mW	850nm	Single mode, polarization locked	
3D Sensing, indoor (IoT)	0.2-4W	850nm	Multimode array for ToF	
Proximity sensor, mobile	5-20mW	940nm	Single Mode or multimode	 
3D camera, mobile, in cabin automotive	0.2-4W	940nm	Multimode array Module w optics	 
LIDAR	>25W	905nm (EELs) 940nm (VCSELs)	Multimode arrays assemblies High T° stability	

II-VI

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