MICROSCAN®

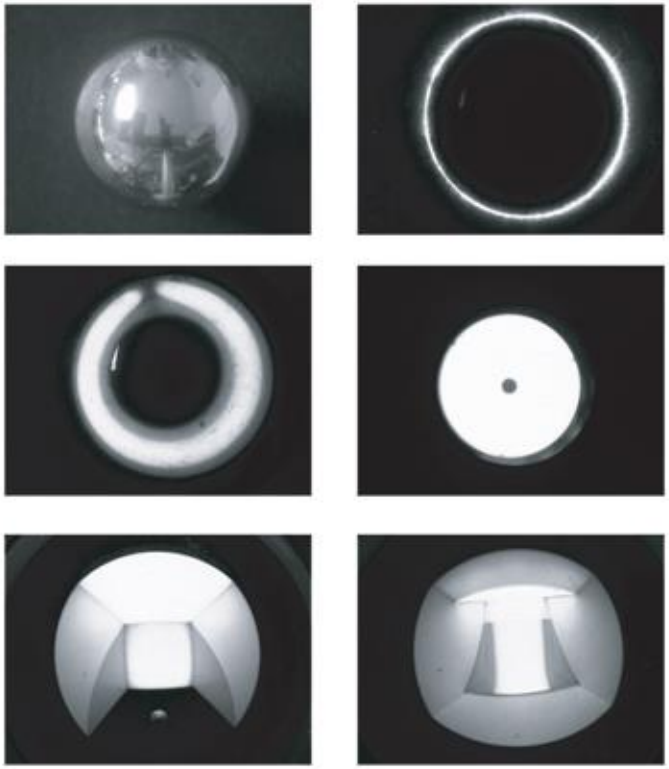
Precision Data Acquisition
and Control Solutions

NERLITE®

Introduction to
Machine Vision Lighting

Agenda

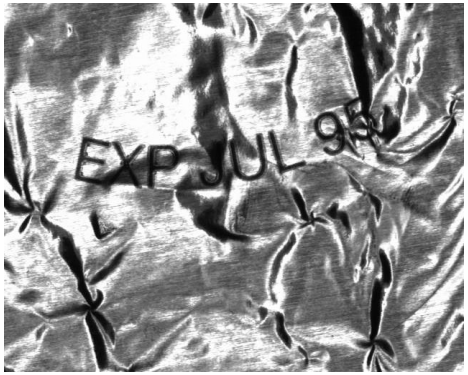
- *What is machine vision lighting?*
- *Understanding lighting concepts*
- *Types of reflection*
- *Bright-field lighting*
- *Dark-field lighting*
- *Summary*
- *Microscan NERLITE products*



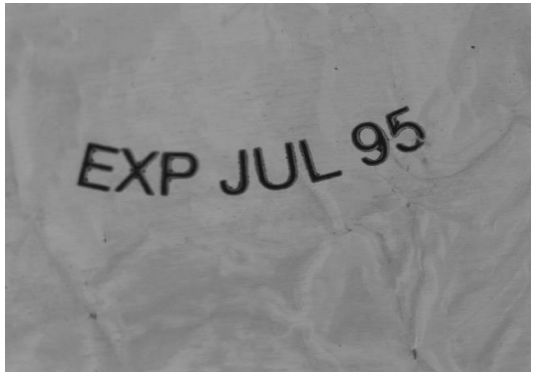
Effects of lighting techniques on a ball bearing

What is machine vision lighting?

- Machine vision lighting is defined as computerized light measurement.
- 90% of the success of any machine vision application is through proper lighting.
- Cameras do not see objects; they see the light reflected from objects towards them.
- If the camera can't see the part or mark, it can't be read and it can't be inspected.



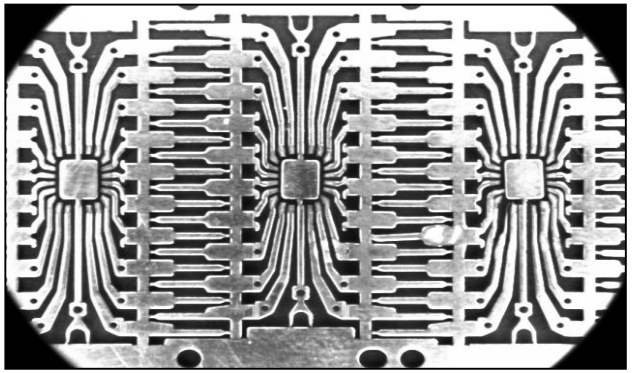
Wrinkled foil with ring light



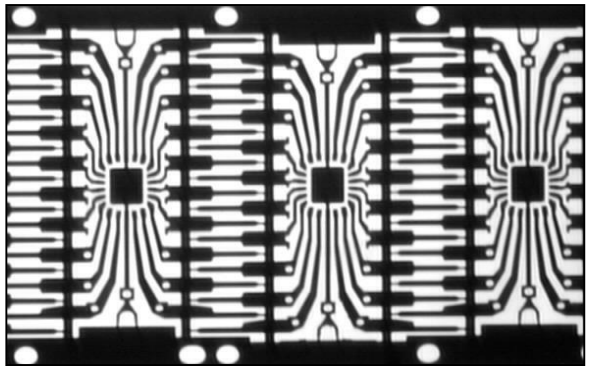
Wrinkled foil with Continuous Diffuse Illuminator (CDI)

Understanding lighting concepts:

- A well planned machine vision lighting application is designed to maximize feature contrast, while minimizing contrast of the rest.
- Images with poor contrast and uneven illumination require more effort from the imager, increasing process time.
- High contrast features simplify integration and improve reliability.
- Variation of the part and environment should not affect the results.



Ring light: Uneven surface brightness will result in challenging inspections

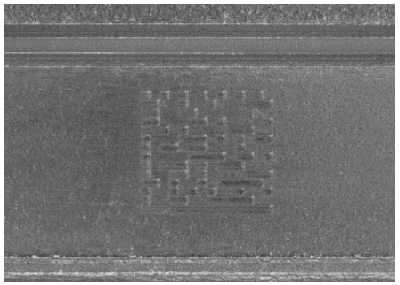


Back light: High contrast image makes for a simple inspection setup

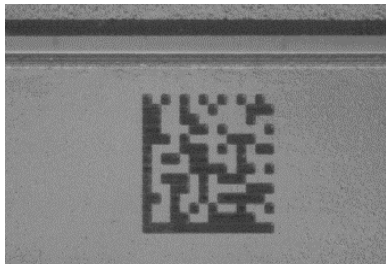
Effective lighting maximizes feature contrast:

In each example, the same part, camera and lens are used. Different light makes the vision processing harder or easier.

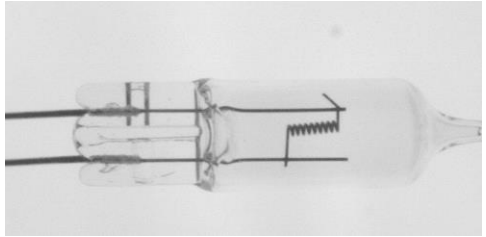
Using a ring light



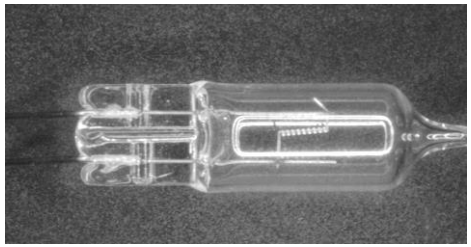
Using a Diffuse On Axis Light (DOAL)



Using a ring light



Using a backlight

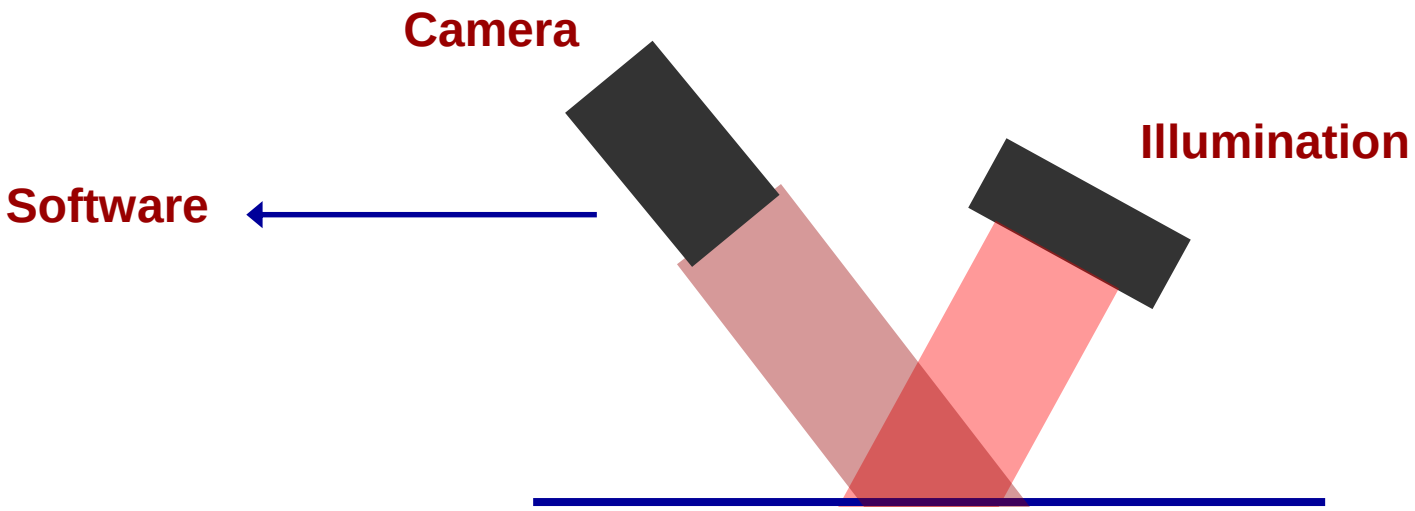


Using a small high ring light

Using a large low ring light

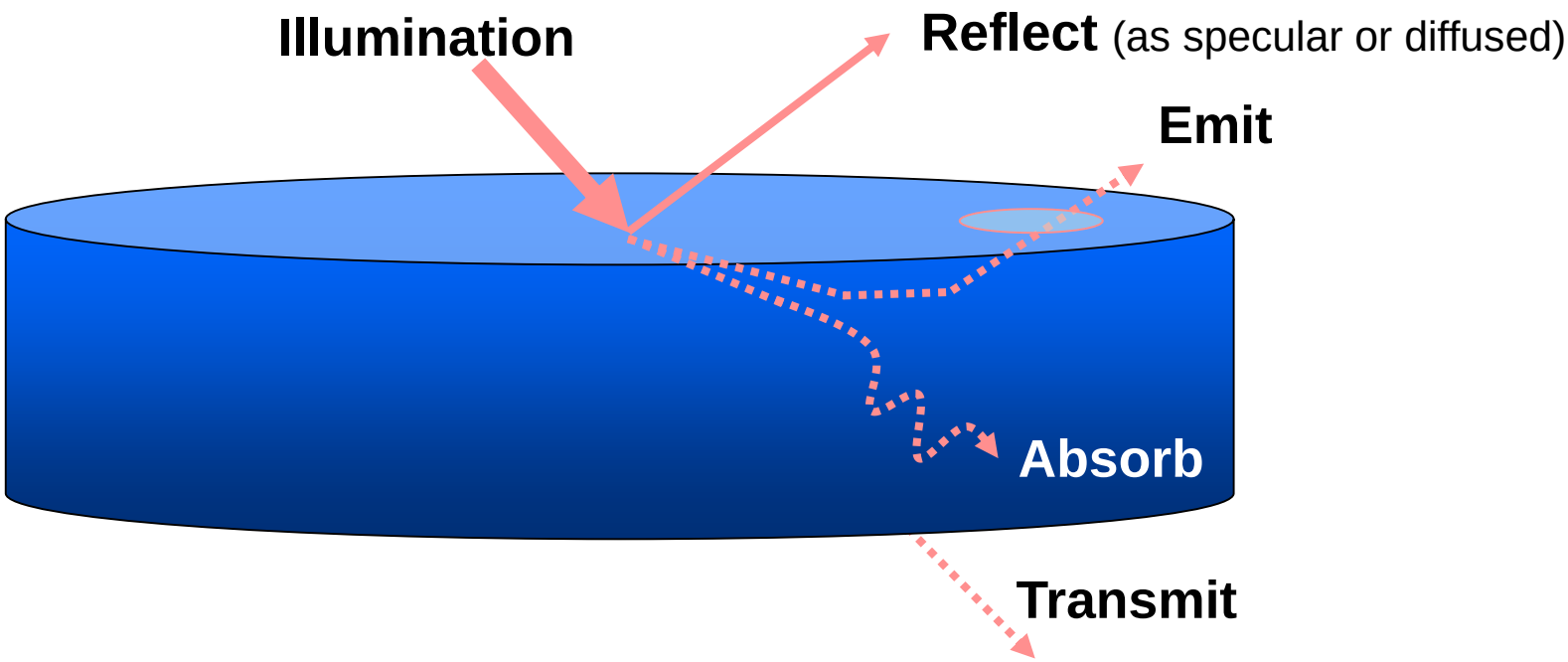
Three parts are needed to make an image:

1. Camera: It looks at the reflected light, not at the part
2. Part: It can reflect light in many ways, so look at the part features
3. Illumination: Broad-band, monochromatic light source, such as NERLITE products



Light as it hits an object:

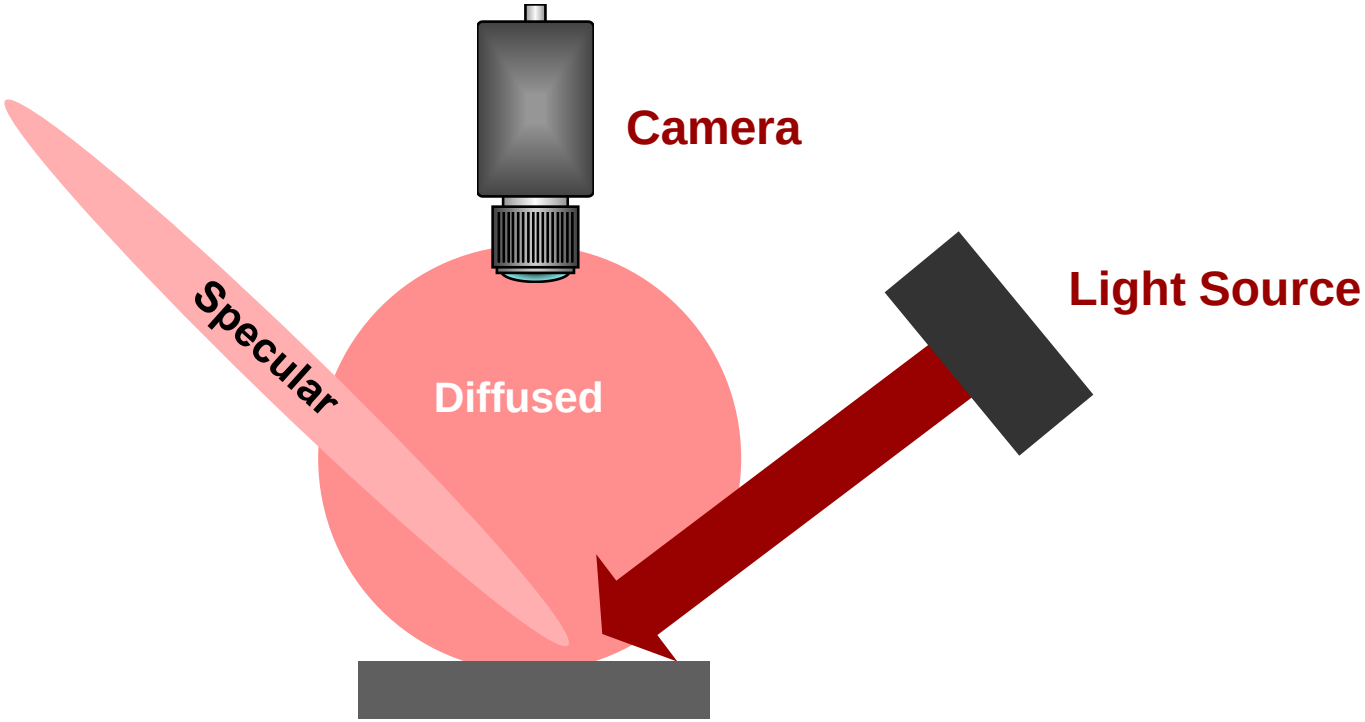
- Light interacts with a part in several ways
- Conservation of energy principal: energy changes in form, but the total amount remains constant
- Understanding how reflection occurs helps to control “hot spots” and achieve even illumination



Two types of reflection:

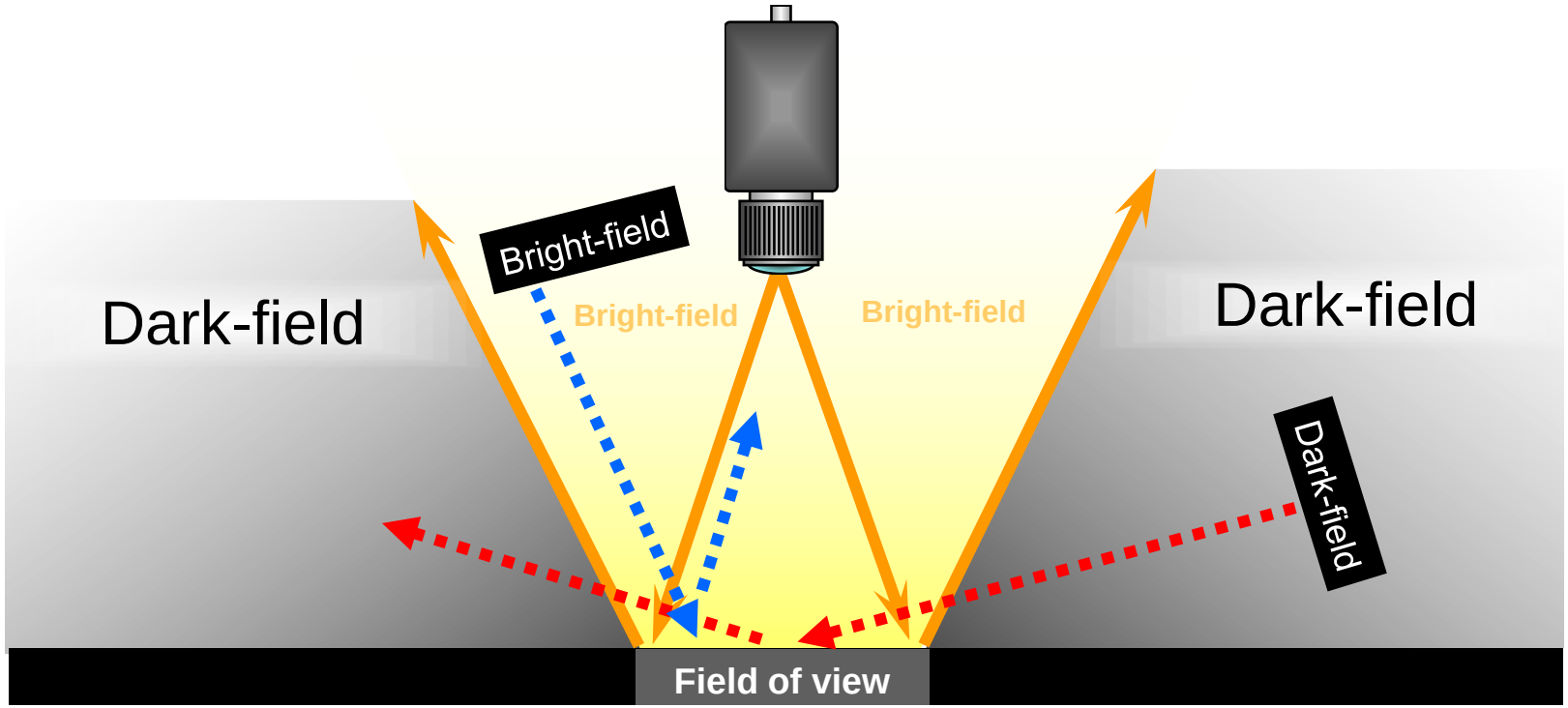
1. Specular: direct reflected light at opposite angle
2. Diffused: scattered light in all directions

Note: Your lighting angle must be correct



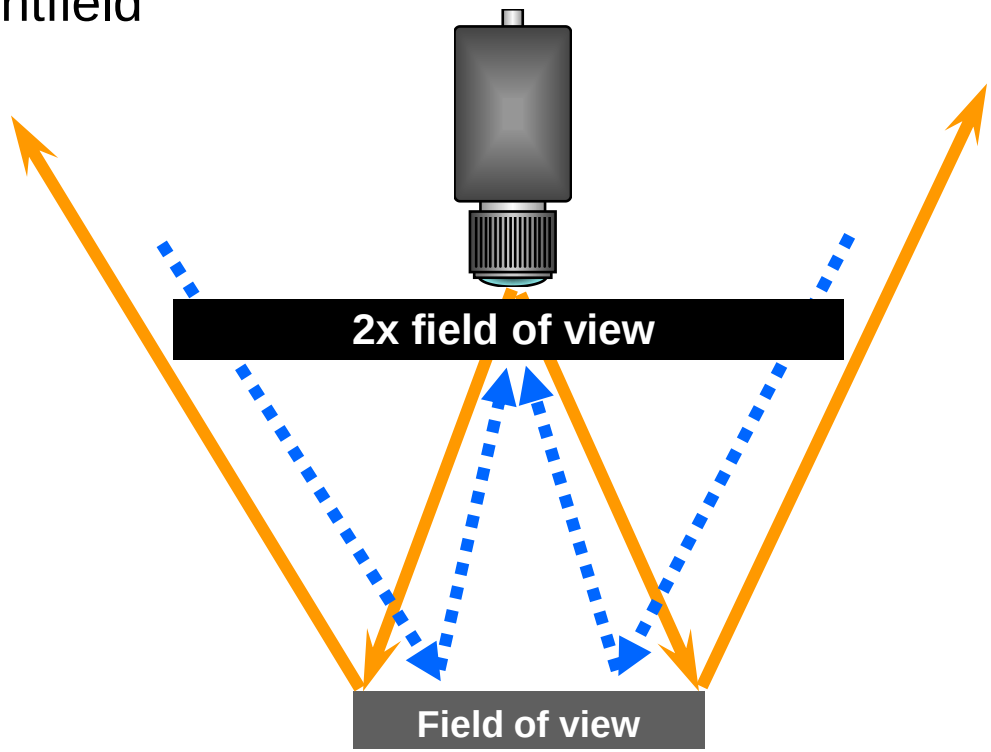
Understand the “W”:

- Reflected light is the same angle as the source
- Bright-field: light is reflected **into** the camera
- Dark-field: light is reflected **away** from the camera



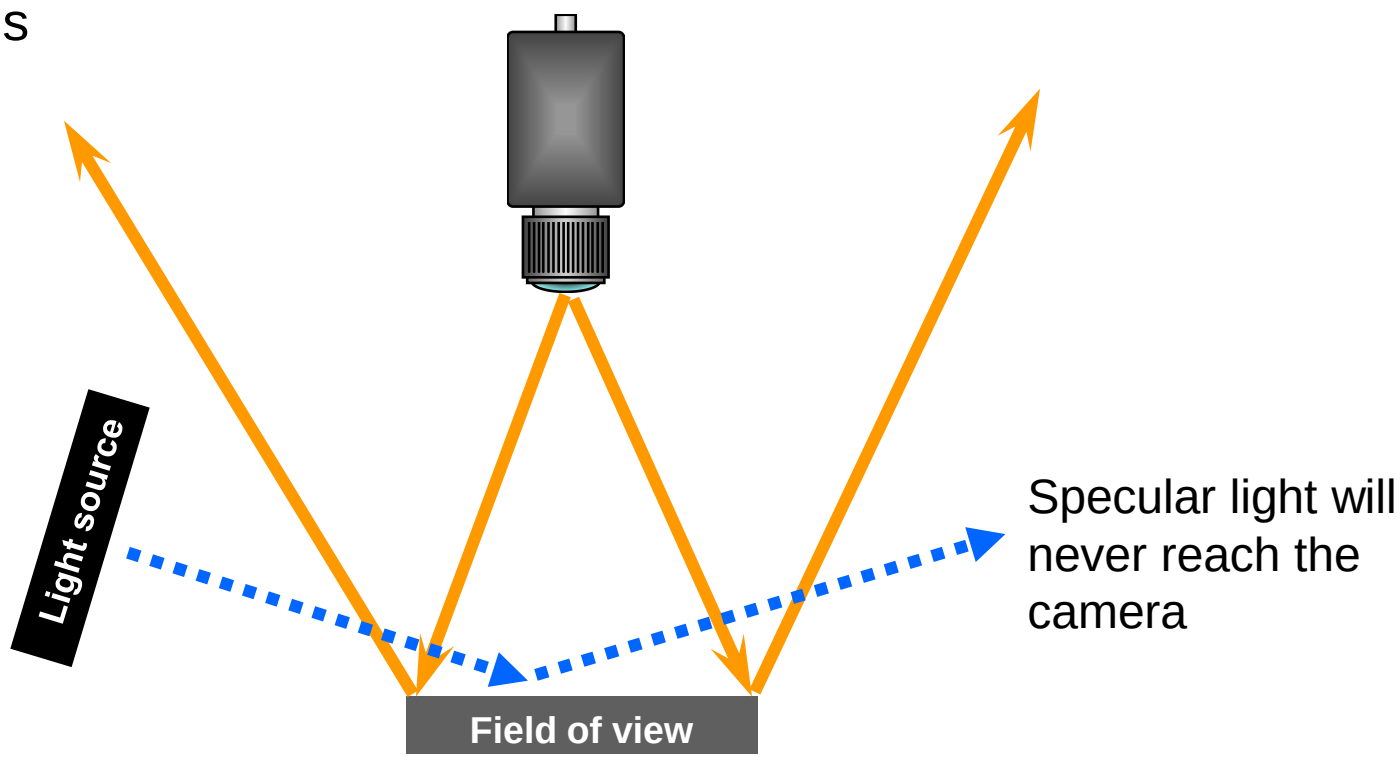
Bright-field lighting:

- Good for high contrast but specular reflections on shiny or reflective surfaces
- Twice the field of view at the camera lens
- **Avoid "hot spots":** Diffused light source provides even illumination in the brightfield



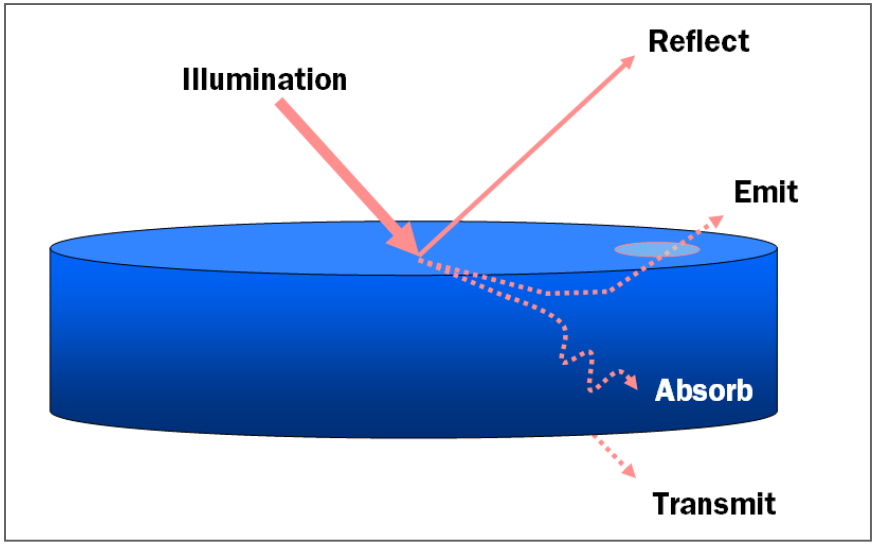
Dark-field lighting:

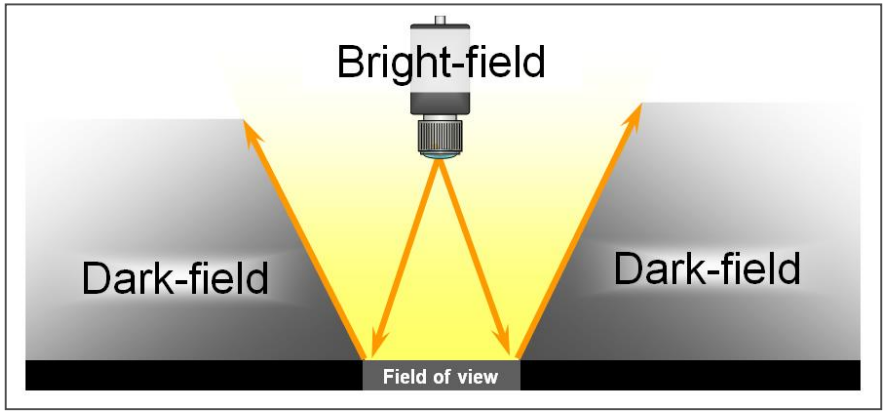
- Diffused light is reflected into the camera and specular light is reflected away
- Light source is outside the “W”
- Light is reflected away except for textured surfaced and elevation changes



Summary

- Maximize contrast on features of interest, and minimize contrast on the rest
- Light contacting an object will reflect, emit, absorb and transmit
- The reflection will be specular or diffused
- The “W” will define where the light is reflected from an object



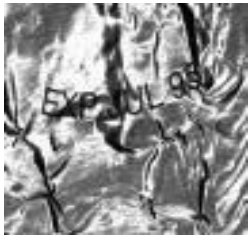


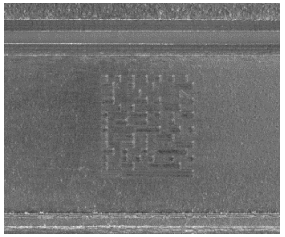
NERLITE Lighting Portfolio

With Microscan NERLITE products, you can light ANY machine vision application to achieve readability.

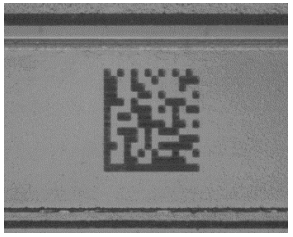
Examples

Before - Difficult to Read



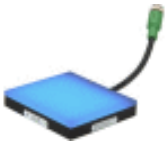


After – Easy to Read with NERLITE!



Area Array Illuminators

Backlights



Ring Illuminators

Darkfield Illuminators

CDI Illuminators

Dome Illuminators

DOAL Illuminators

Mounted Illuminators

Thank You.

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