

# ILLUMINATING THE CRIME

## Alternative (ALS), Multispectral (MSI) and Hyperspectral (HSI) Light Sources for Forensic Body Fluid Screening

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### Background

**Body Fluids (BF)**, encountered at crime scenes provide:

1. Sources of DNA
2. Contextual information

#### Traditional Screening Methods

1. Use destructive chemicals
2. Are non-specific
3. Rely on visual appearance

### Light Sources: Significance

1. **Non-destructive:** reduce contamination and dilution
2. **Rapid scanning:** time-sensitive and high-volume caseloads
3. **Across different surfaces:** versatile at various crime scenes

**BUT FALSE POSITIVES EXIST**



**Aim: To determine when the light works and when it doesn't**

### Method

#### SAMPLE TYPE

Pure Body Fluid

Body Fluid Mixture

Interference Samples

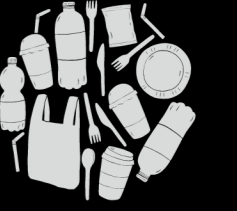
#### SUBSTRATE



Wool

Cotton

Polyester



Glass

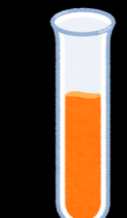
Metal

Plastic

#### DILUTION



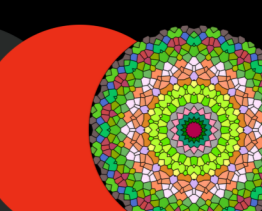
Neat



1:10



1:100



White  
Black  
Red

Patterned

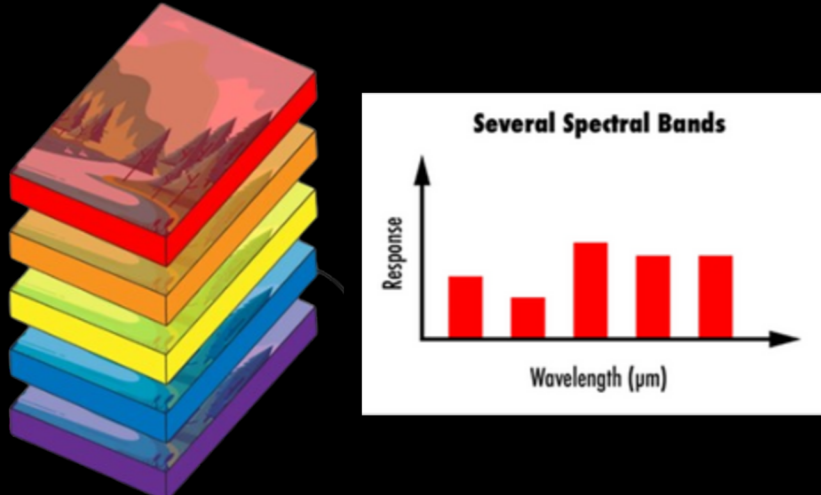
### Forensic Light Sources

#### Alternative Light Source (ALS)



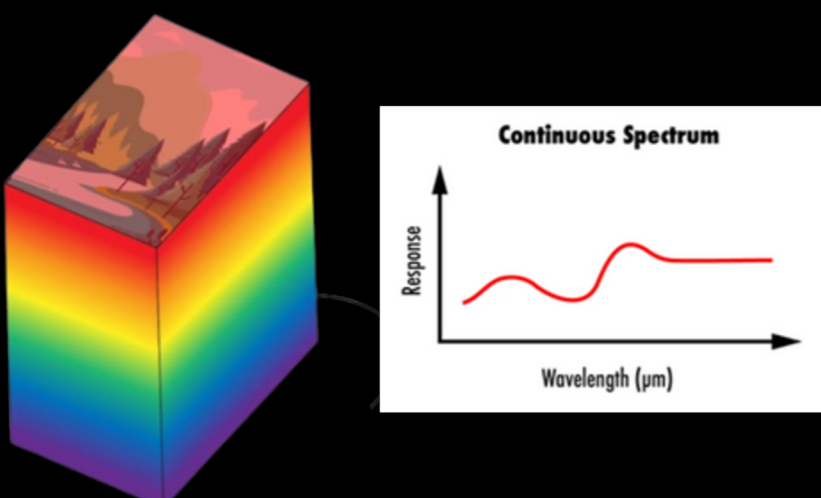
- A single wavelength of light
- E.g. Blue light, green light

#### Multispectral Imaging (MSI)



- Wavebands
- Captures spectral details across a broader range of wavelengths

#### Hyperspectral Imaging (HSI)

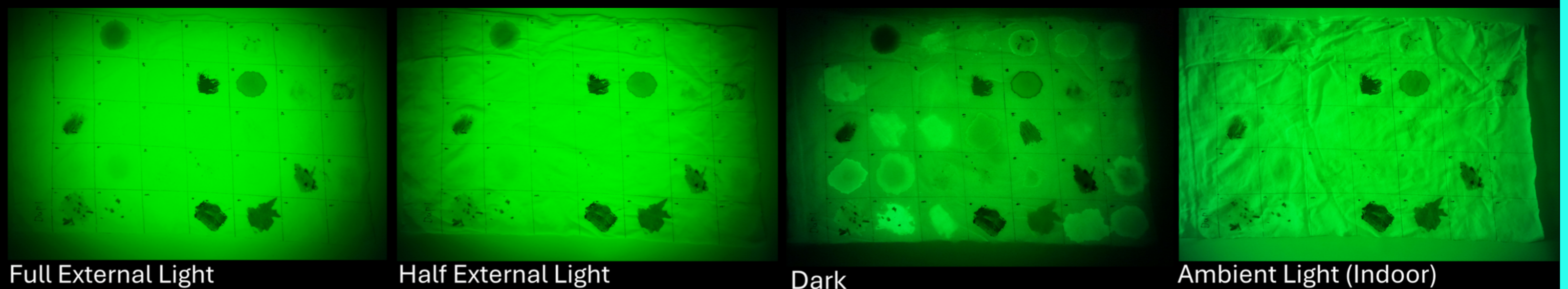


- Emits an even wider range of wavelengths continuously

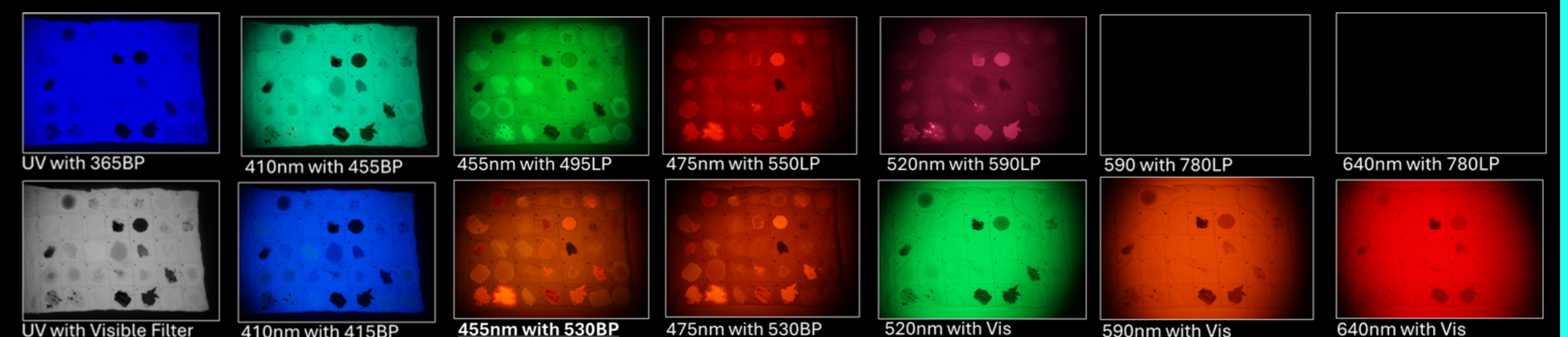
### Results: Interference Samples on White Cotton with Crime-lite® AUTO (MSI)

#### BACKGROUND LIGHTING

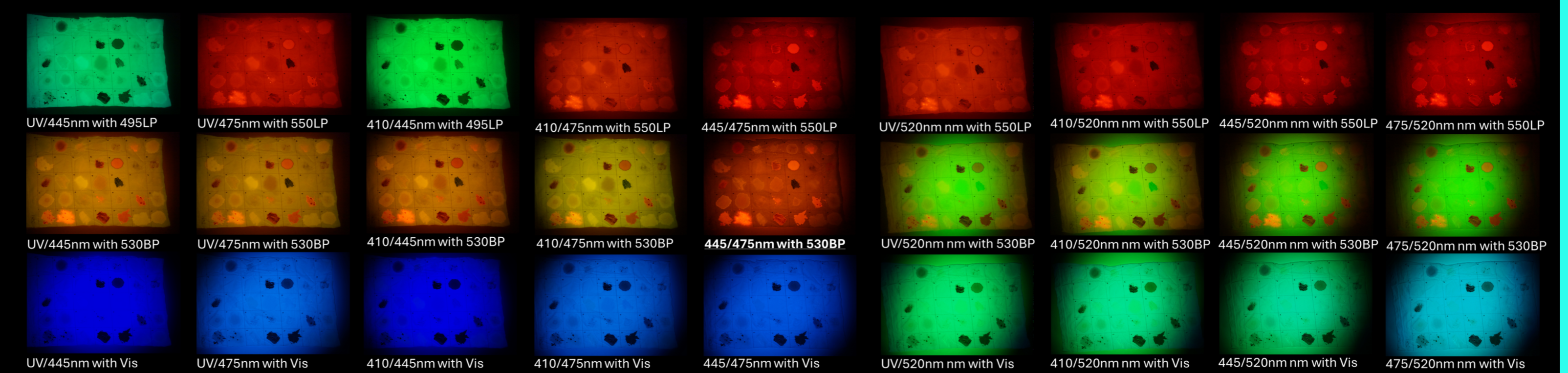
Fluorescence was only observed in complete darkness, therefore all subsequent experiments were conducted under dark conditions to avoid background interference



#### SINGLE WAVELENGTH

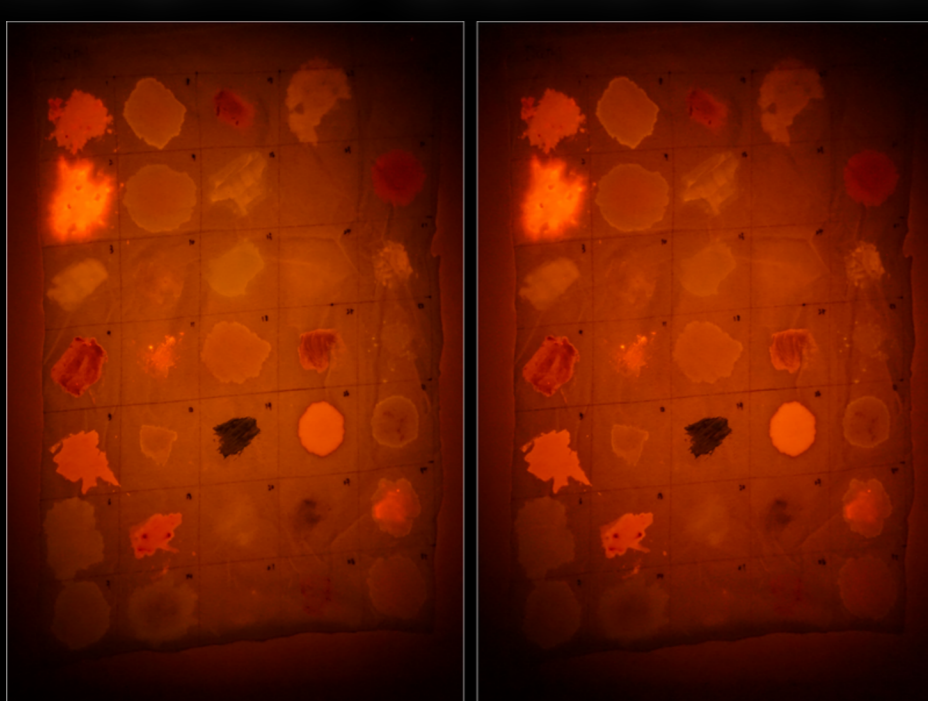


#### MIX OF 2 WAVELENGTHS



BP = Bandpass filter; LP = Longpass filter

### Interim Conclusion



455nm with 530BP 455/475nm with 530BP

- 455 nm (blue) exhibited most false fluorescence for interference materials
- Blue is the best for forensic BF Screening



- Lots of false positives

### What's Next?

- Currently waiting for sample collection from participants
- Test on body fluids with more variables
- Data analysis
  - Visual Assessment
  - Grey Scale



#### Key References

De Cássia Mariotti, K., Ortiz, R. S., & Ferrão, M. F. (2023). Hyperspectral imaging in forensic science: An overview of major application areas. *Science & Justice*, 63(3), 387–395. <https://doi.org/10.1016/j.scjus.2023.04.003>

Forensic Technology Center of Excellence (2018). Landscape study of alternative light sources. Research Triangle Park, NC: RTI International. <https://forensiccoe.org/a-landscape-study-of-alternate-light-sources/>

Harbison, S., & Fleming, R. (2016). Forensic biological sample identification: state of the art. *Research and Reports in Forensic Medical Science*, 11. <https://doi.org/10.2147/rrfms.s57994>

Zapata, F., De La Ossa, M. A. F., & García-Ruiz, C. (2015). Emerging spectrometric techniques for the forensic analysis of body fluids. *TrAC, Trends in Analytical Chemistry (Regular Ed.)*, 64, 53–63. <https://doi.org/10.1016/j.trac.2014.08.011>

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