

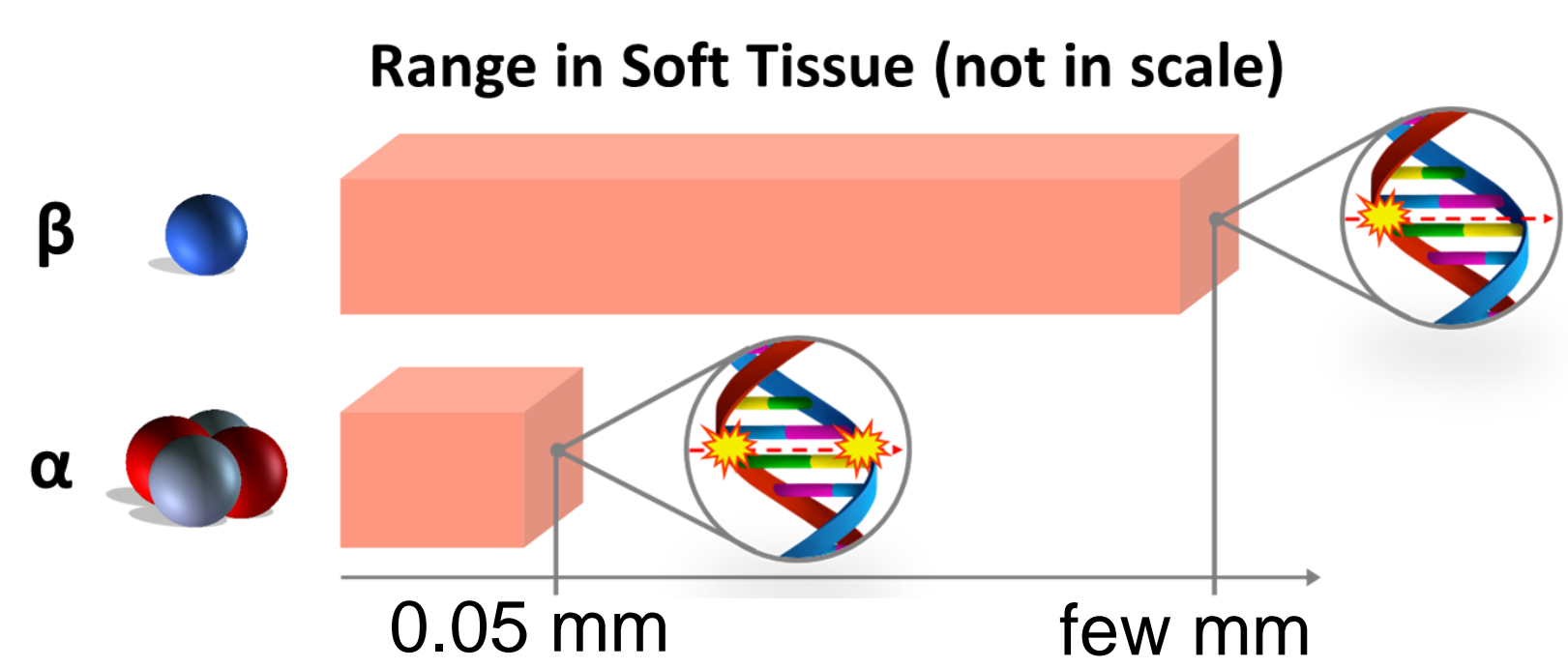
# Live Imaging of Alpha Radiation sources via radioluminescence in nitrogen flushed glovebox

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## Introduction

### Alpha Radiation



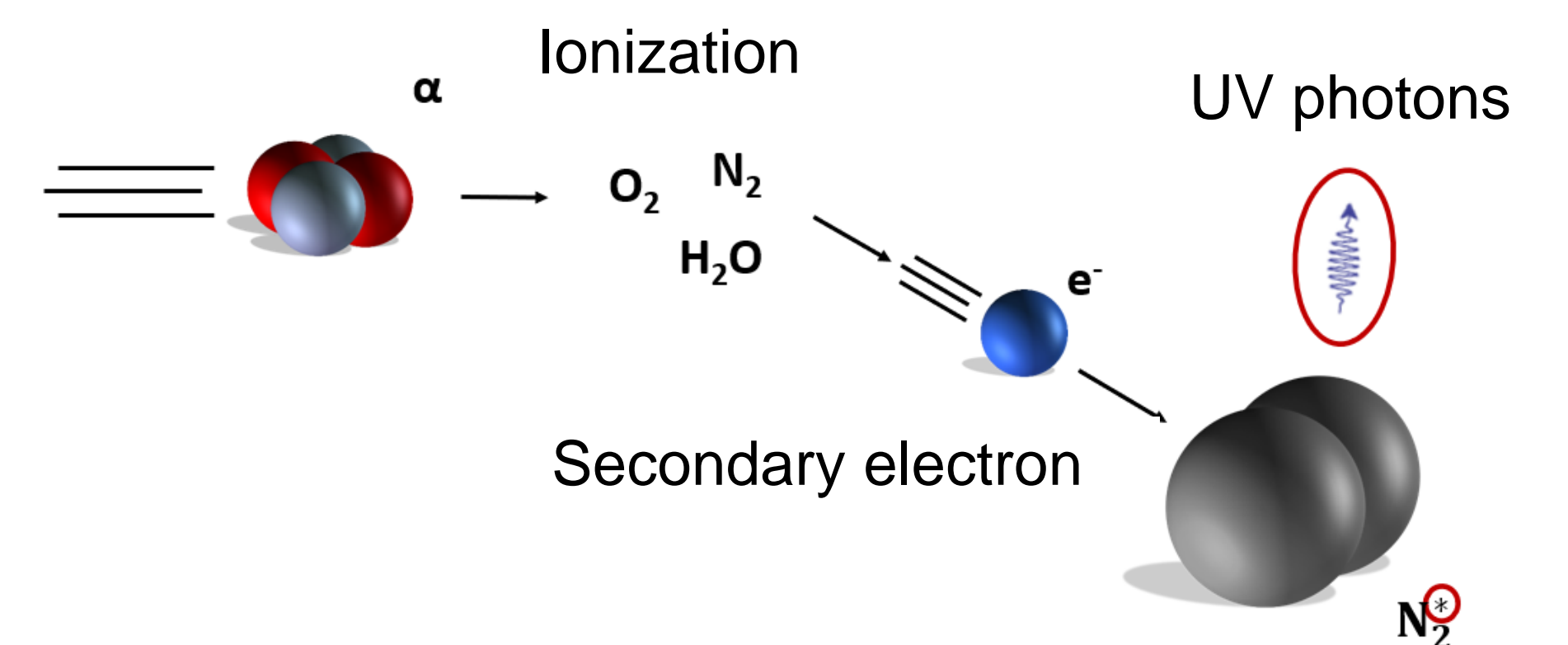
- Ionization effects are concentrated in a small volume
- The damage on DNA strands is harder to repair
- Internal exposure is extremely harmful

### Conventional methods for alpha detection



- Direct interaction between the detector and alpha particles is required. Range of alpha particles in air is ~ 4 cm
- Hazardous to workers

### Radioluminescence

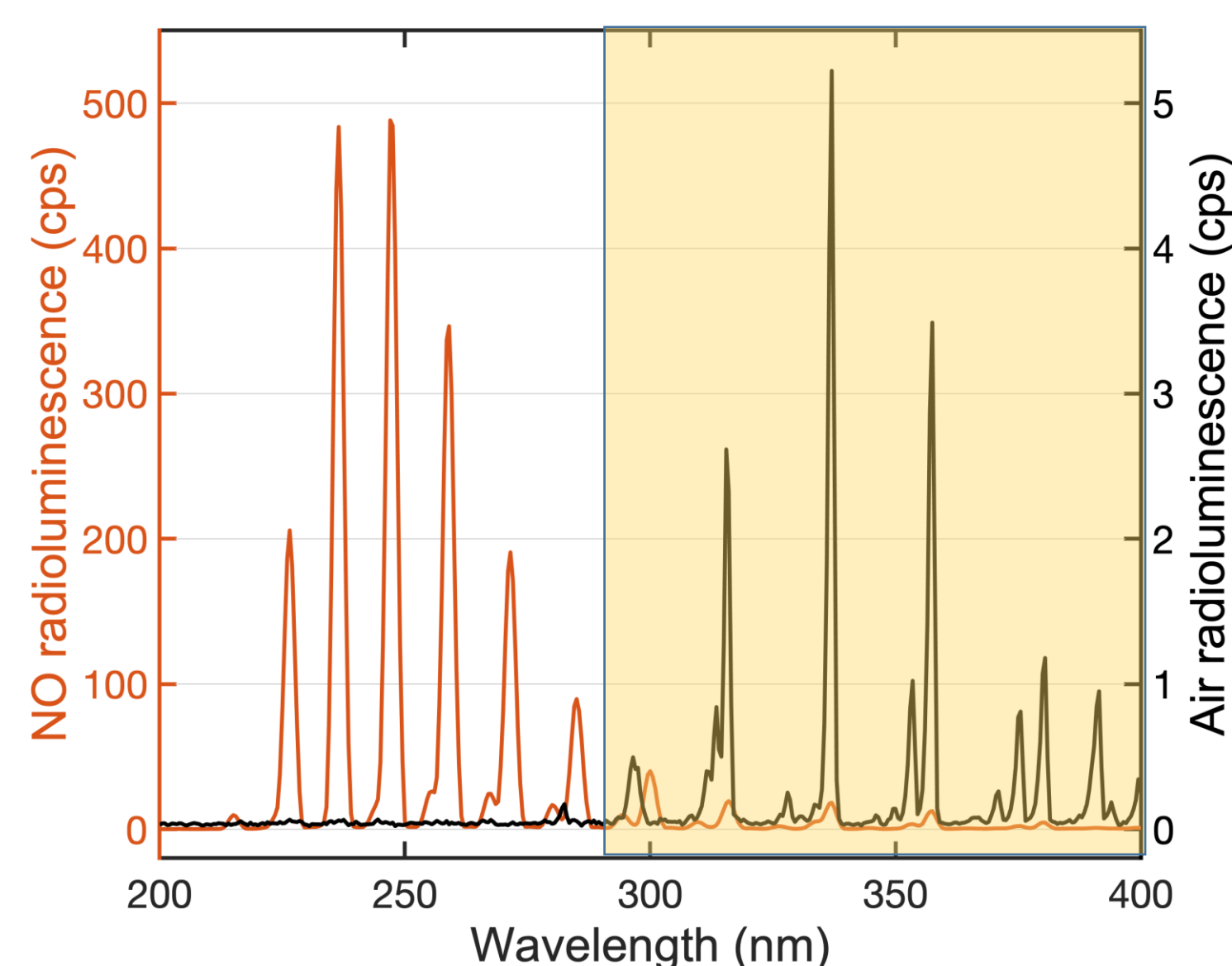


- ~ 100 photons per α
- Energy conversion efficiency:  $6.7e^{-5}$  [1]
- UV photons can travel for hundreds of meters in atmosphere

## Enhancing Radioluminescence with N2 and NO

### Effects of Nitrogen Atmosphere on Radioluminescence

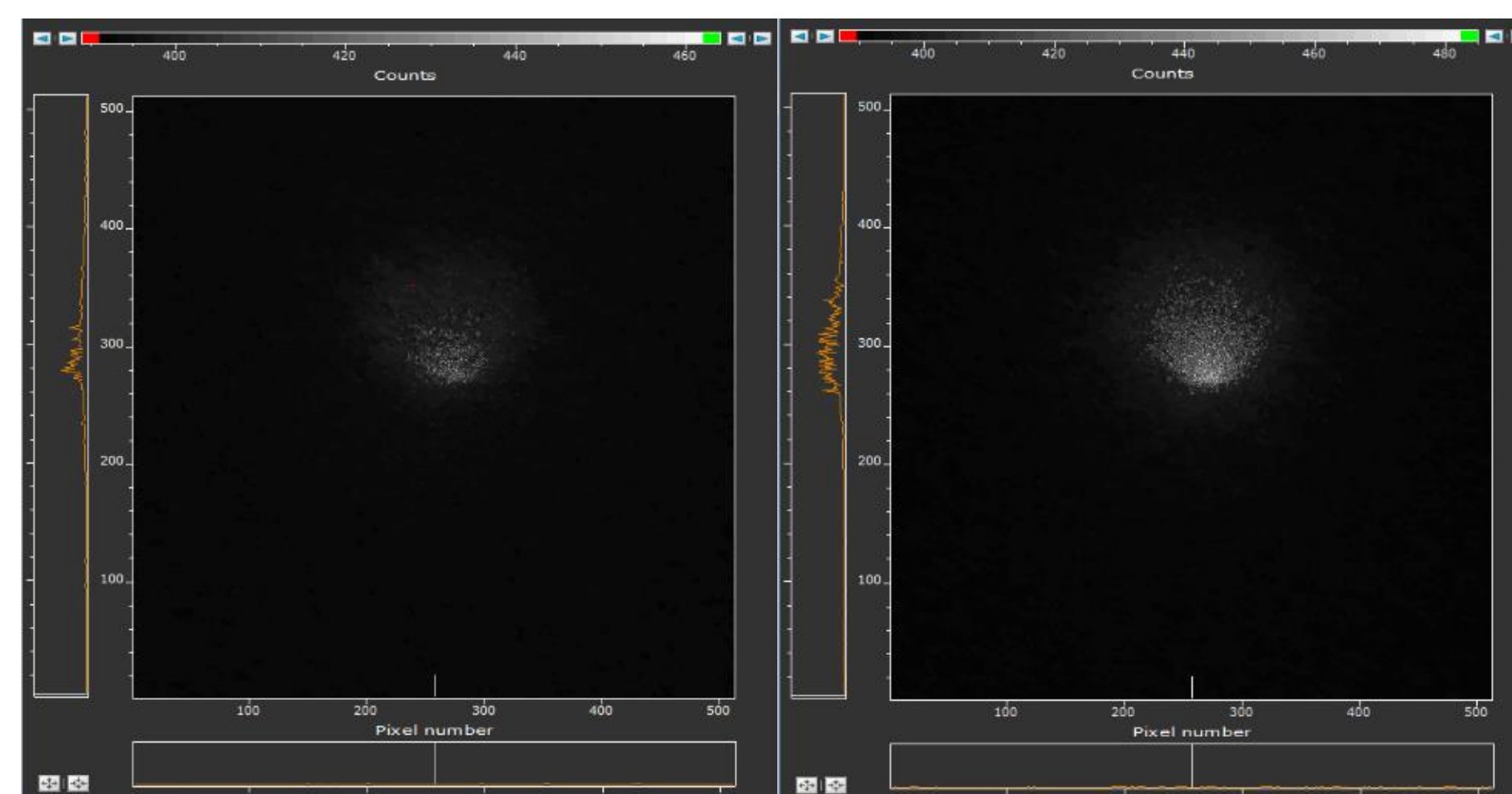
- Radioluminescence signal increases significantly in nitrogen atmosphere
- Shorter measurement time and increased sensitivity can be achieved



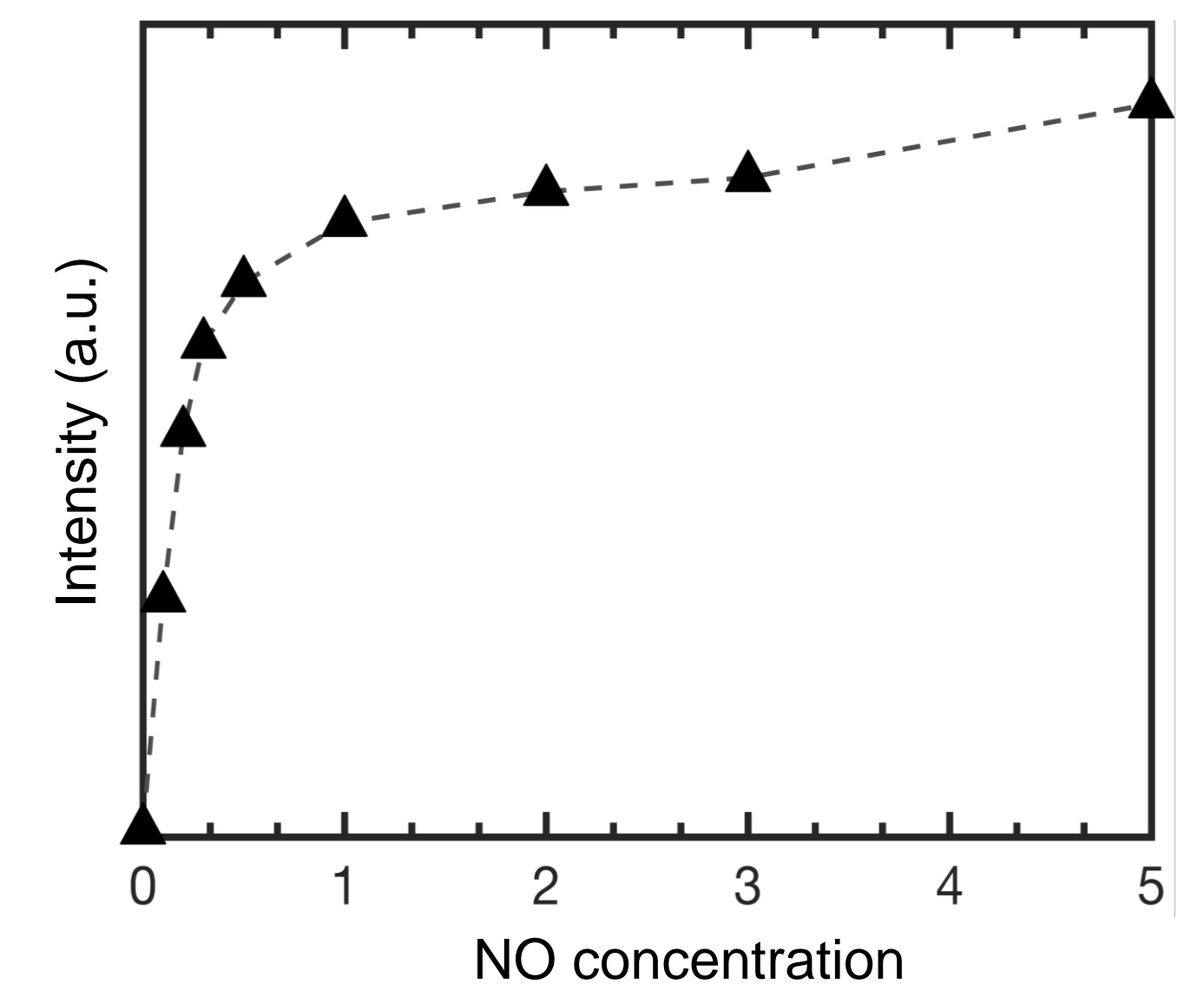
Radioluminescence of 50 ppm N<sub>2</sub>/NO mixture and air

### Further Enhancing the Signal with Nitric Oxide

- NO further enhances the signal, especially in the solar blind region [2]
- The technique could be used for radioactivity measurements in gloveboxes



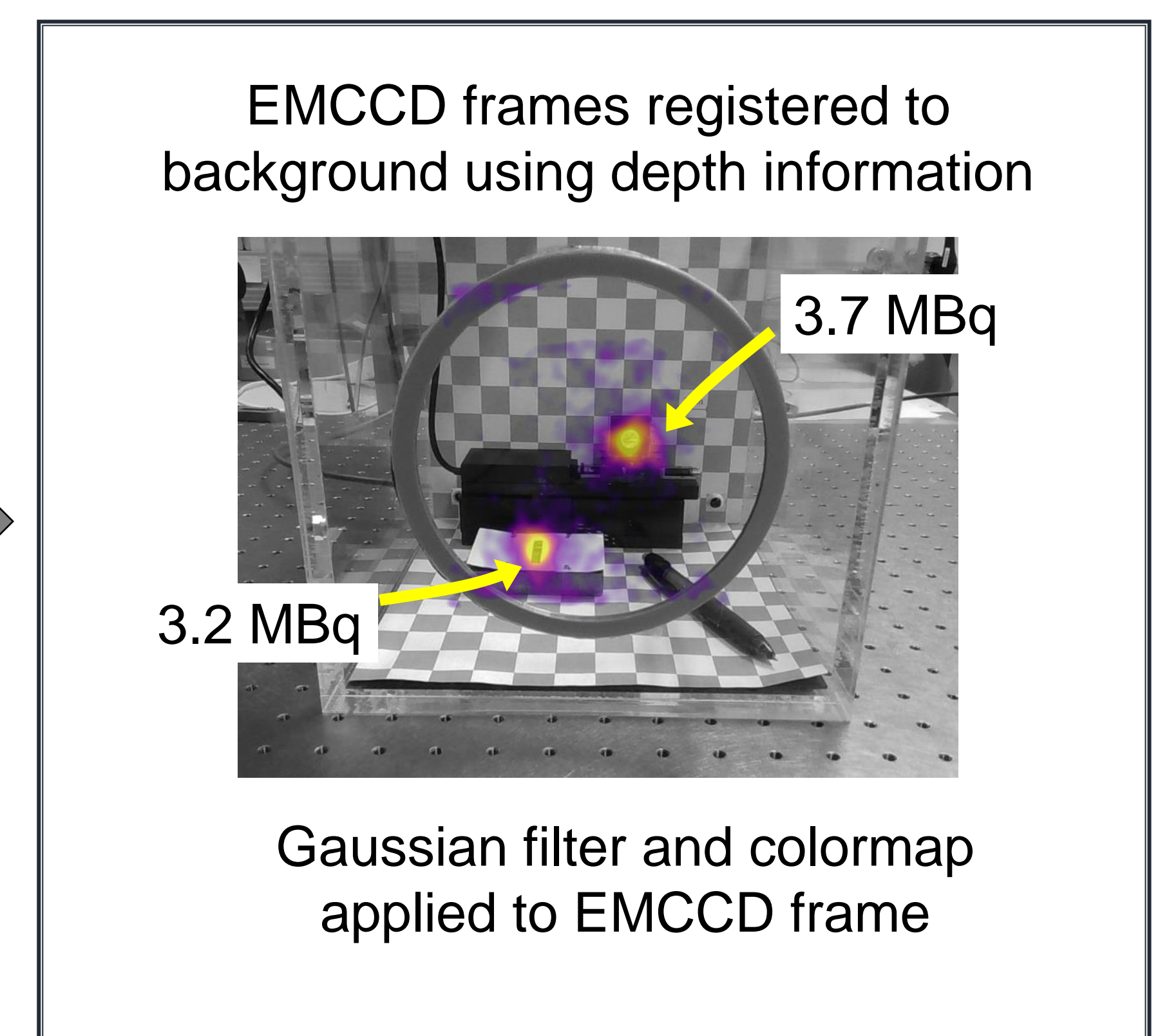
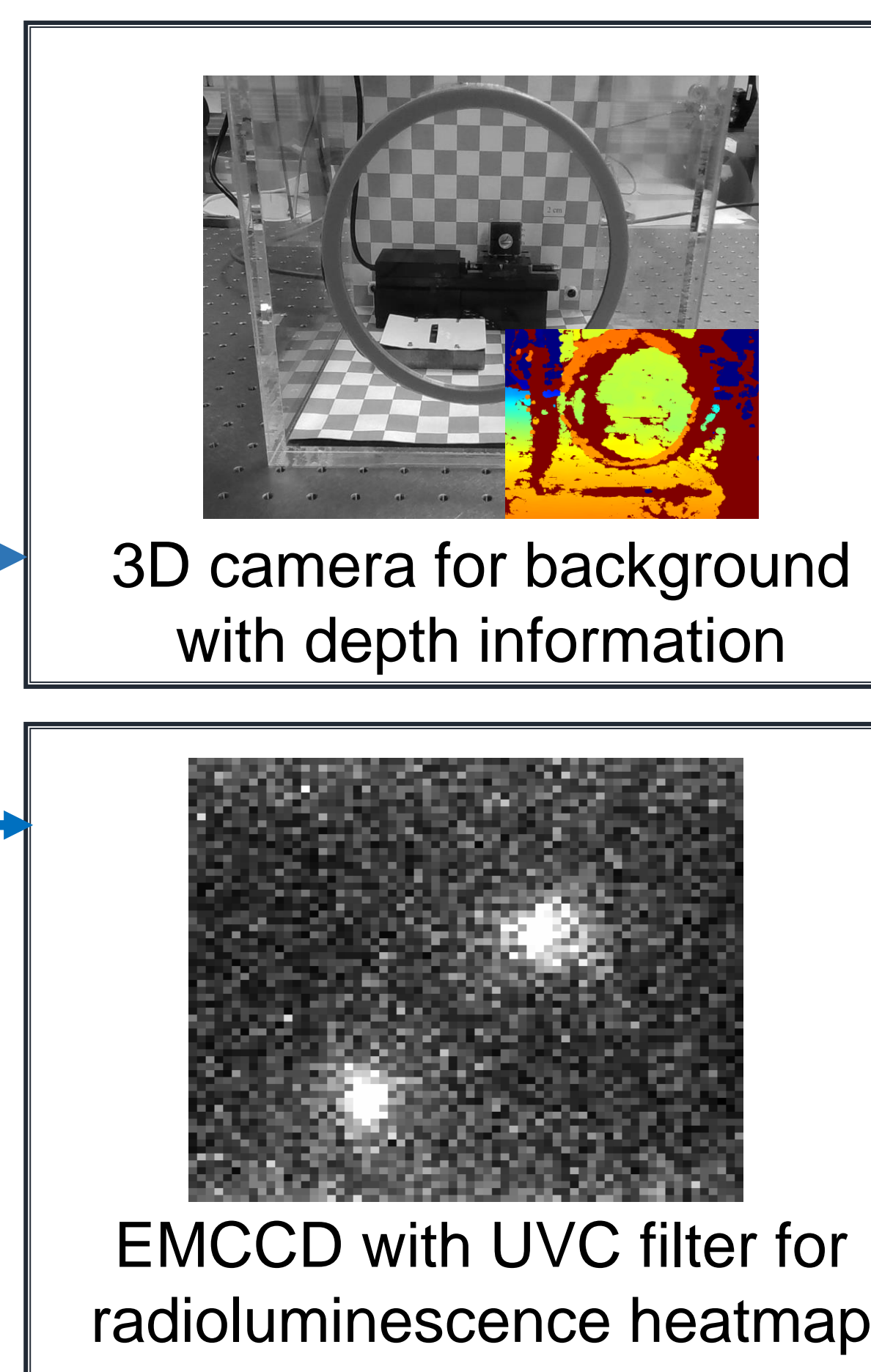
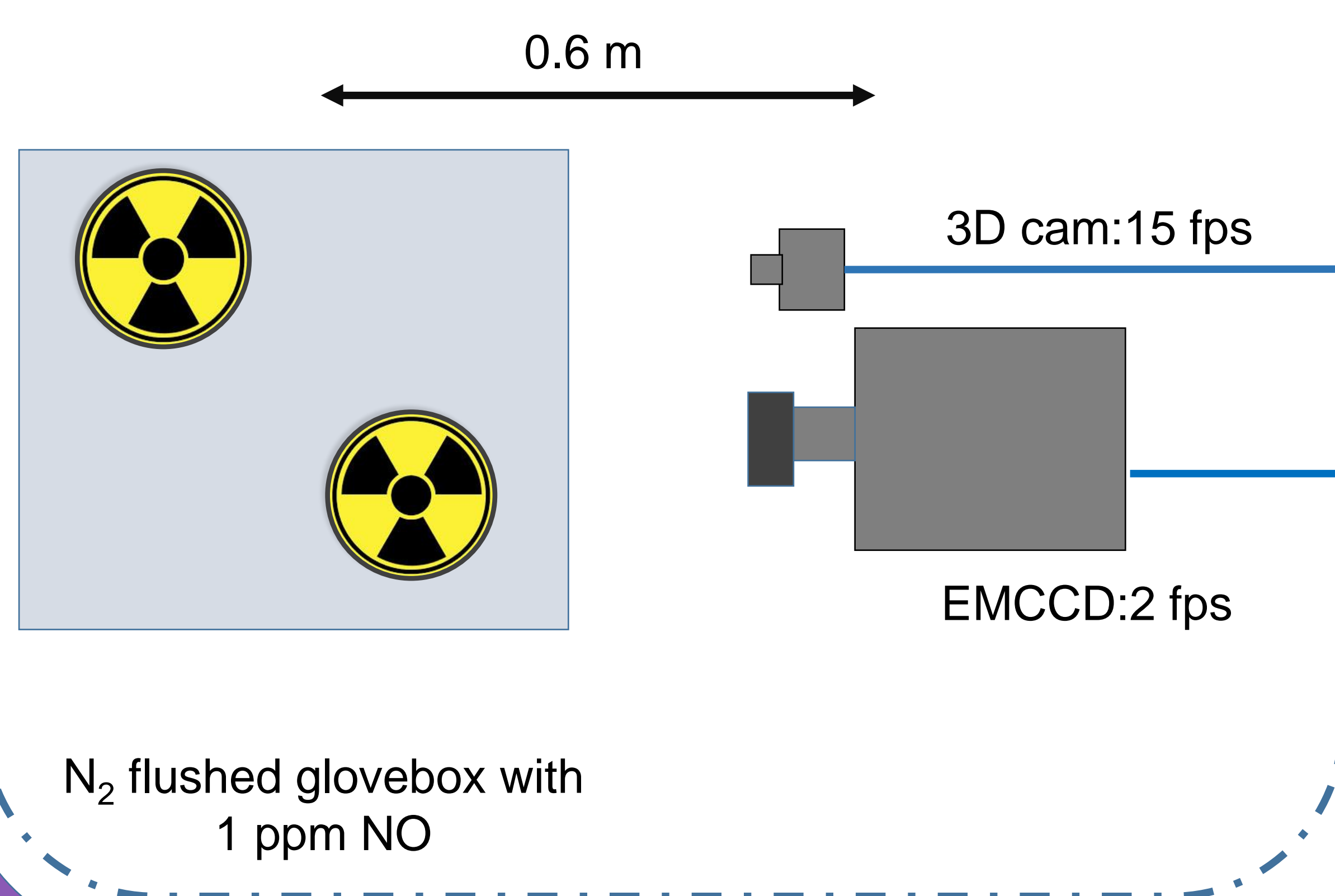
Increase in signal strength with increasing NO concentration. Images taken at 0.1 ppm and 1 ppm of NO concentrations respectively.



Intensity Vs NO concentration

## Real-time Detection of Alpha Radiation

### Experimental setup



## Conclusions

- Enhancing the radioluminescence signal with nitric oxide in a nitrogen atmosphere was studied. The technique could be used in gloveboxes in nuclear facilities.
- Real-time imaging of alpha radiation is possible using this technique.
- Daylight imaging is made possible.

## References

- [1] J Sand et. Al., New J. Phys., vol. 16, p. 053022, 2014
- [2] T. Kerst et. Al., Optics Express, vol. 26, no. 26, pp. 33764-33771, 2018