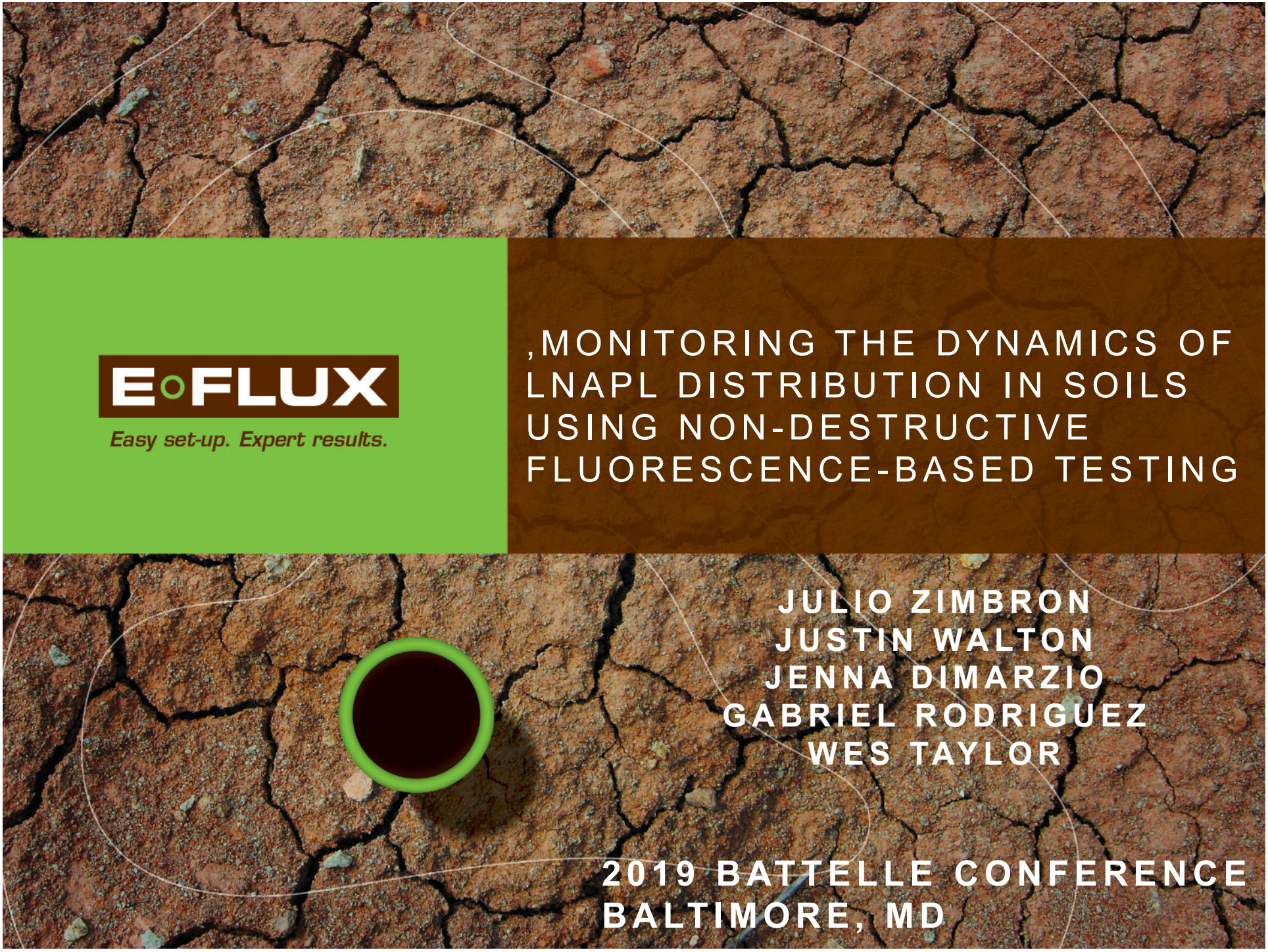

E•FLUX

Easy set-up. Expert results.

‚MONITORING THE DYNAMICS OF LNAPL DISTRIBUTION IN SOILS USING NON-DESTRUCTIVE FLUORESCENCE-BASED TESTING

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2019 BATTELLE CONFERENCE
BALTIMORE, MD

Outline

- Brief review of UV based characterization methods
- Motivation
- Methodology
- Results
- Summary

Review: UV-based HRSC

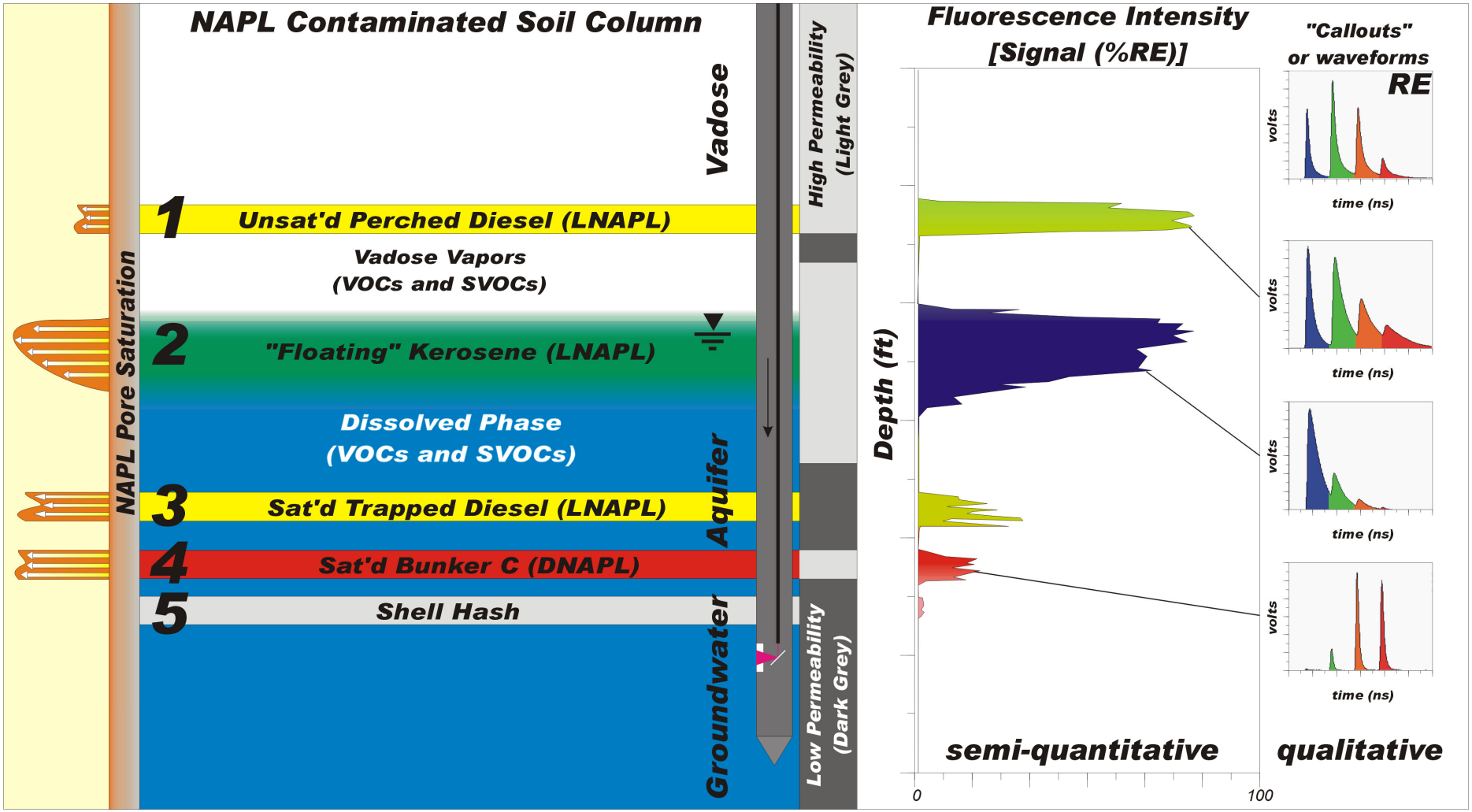
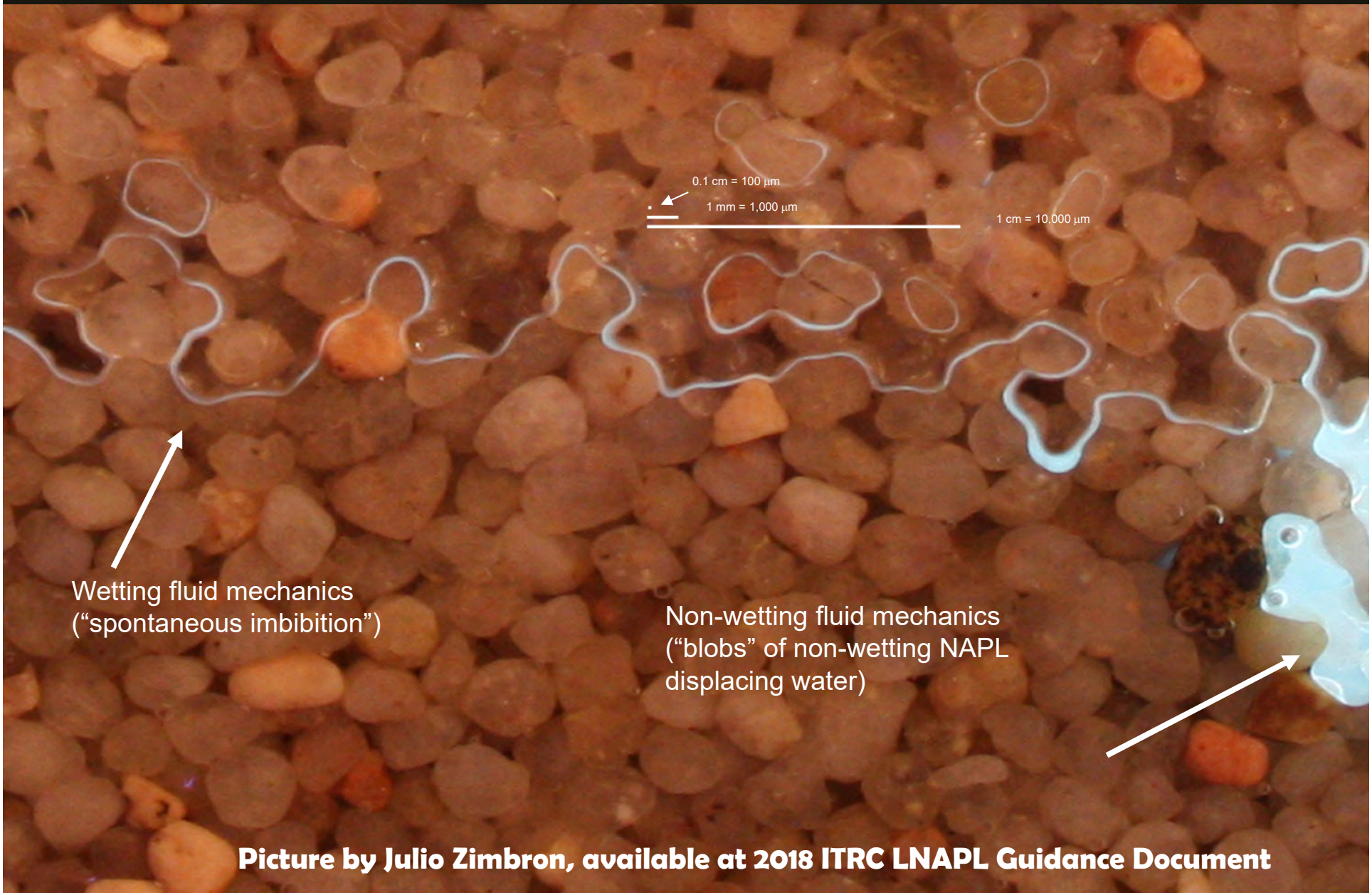


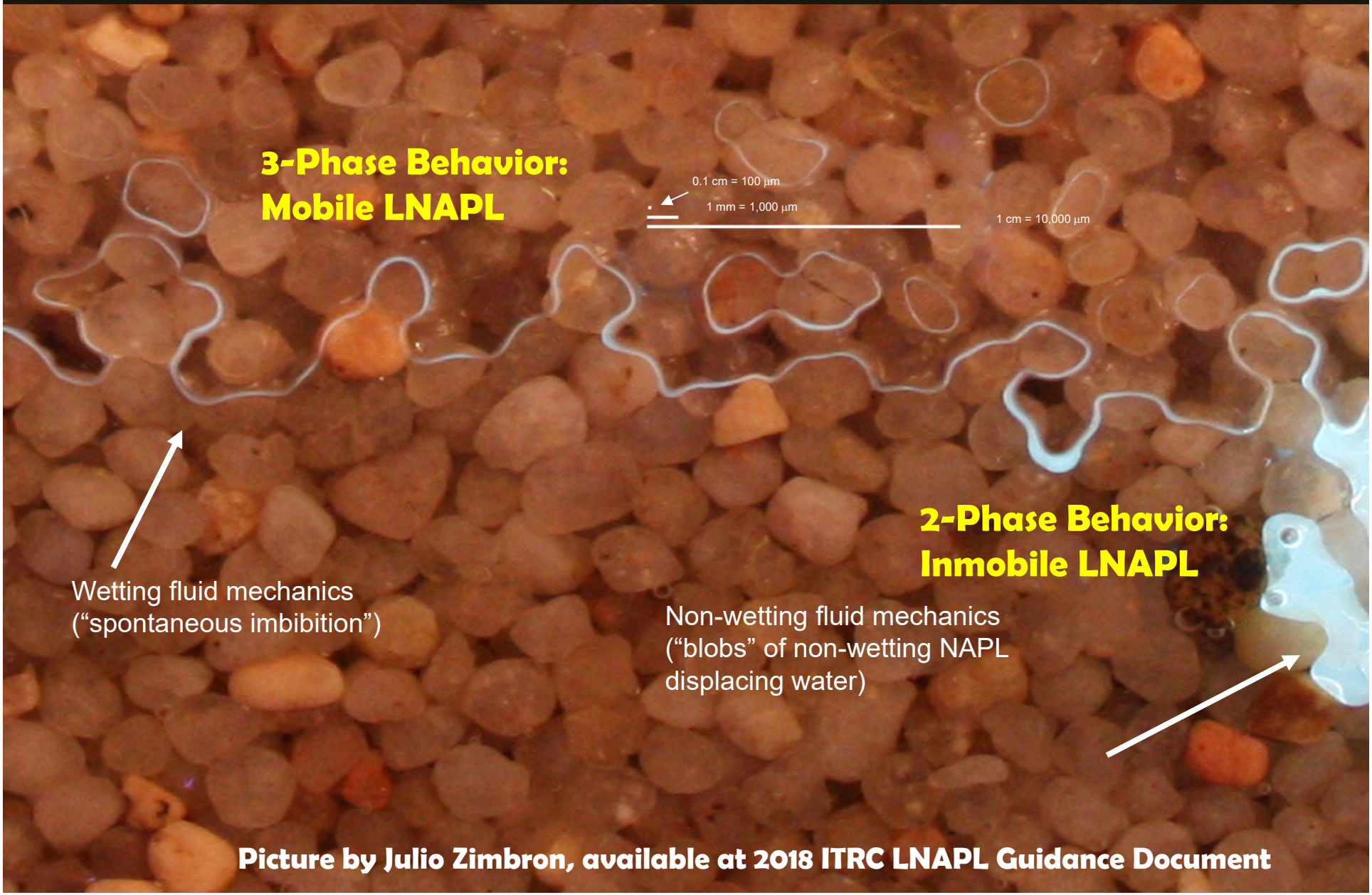
Image from Dakota Technologies (used with permission)

Sand Tank Experiments Lessons



Picture by Julio Zimbron, available at 2018 ITRC LNAPL Guidance Document

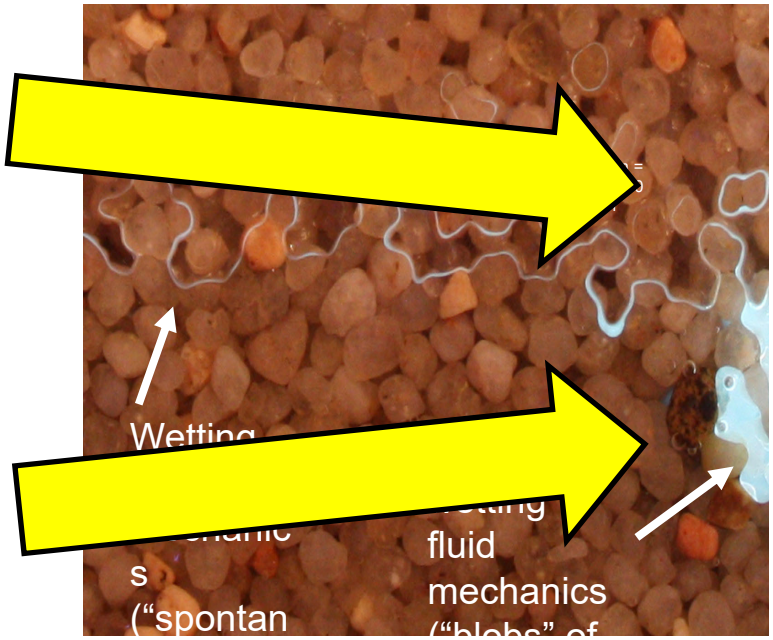
Sand Tank Experiments Lessons



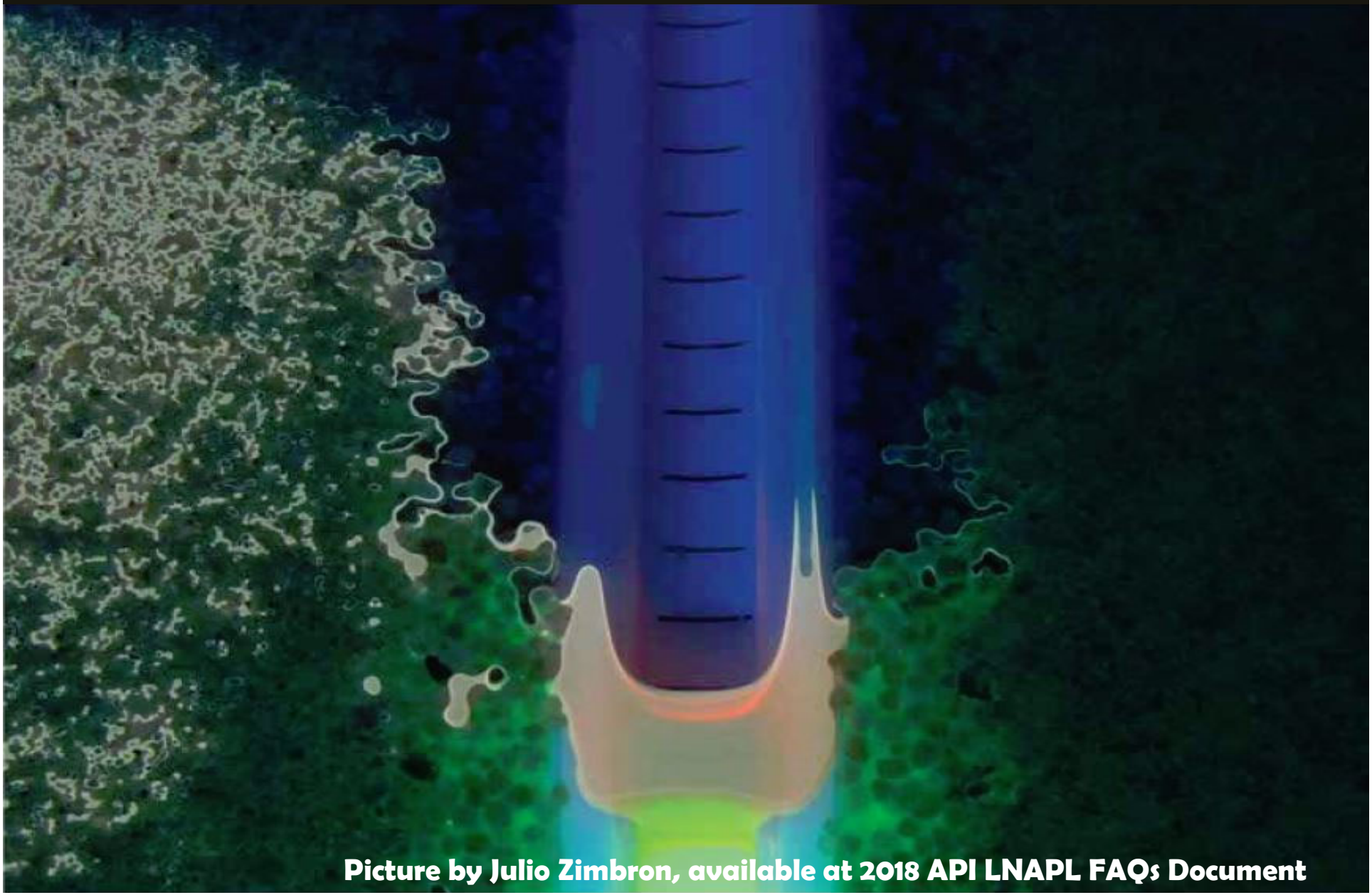
Picture by Julio Zimbron, available at 2018 ITRC LNAPL Guidance Document

Outline

Fluid Phases	Oil Displacement Mechanics	Oil Behavior	Oil Mobility
3: Water Oil Air	Surface tension based	Oil is wetting on water-coated surfaces	High
2: Water Oil	Hydraulic (head > oil displacement pressure)	Oils is non wetting, fills full pores	Very Low



Sand Tank Experiments Lessons



Picture by Julio Zimbron, available at 2018 API LNAPL FAQs Document

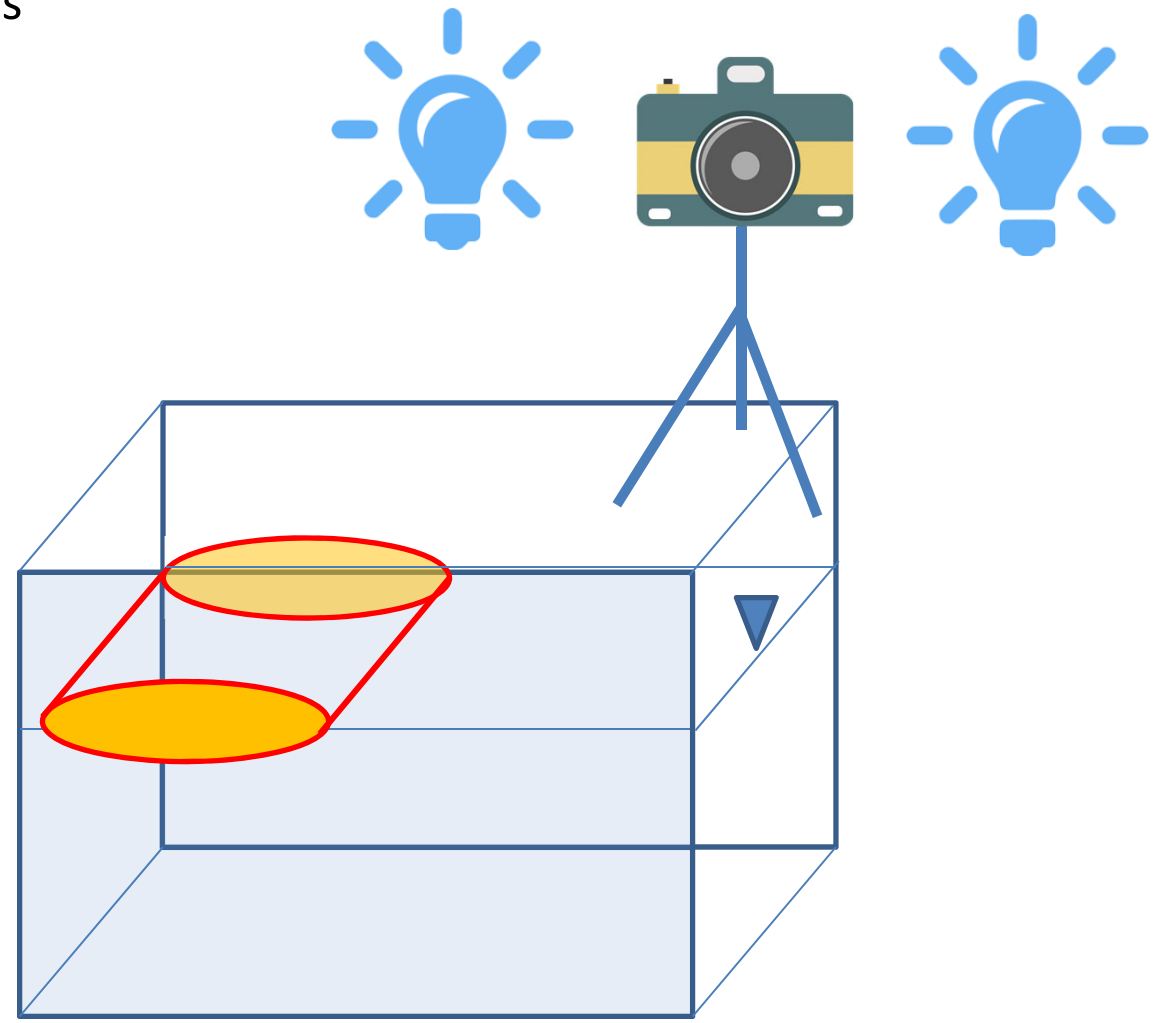
Motivation

- Sand tank experiments: great by not field applicable
- Optically-based HRSC: great and field applicable but mostly used as a single time (snapshot) characterization tool
- LNAPL distribution is not static- needs tools that can adapt to dynamic monitoring

Can optical-HRSC tools be adapted to a dynamic LCSM as non-destructive versions?

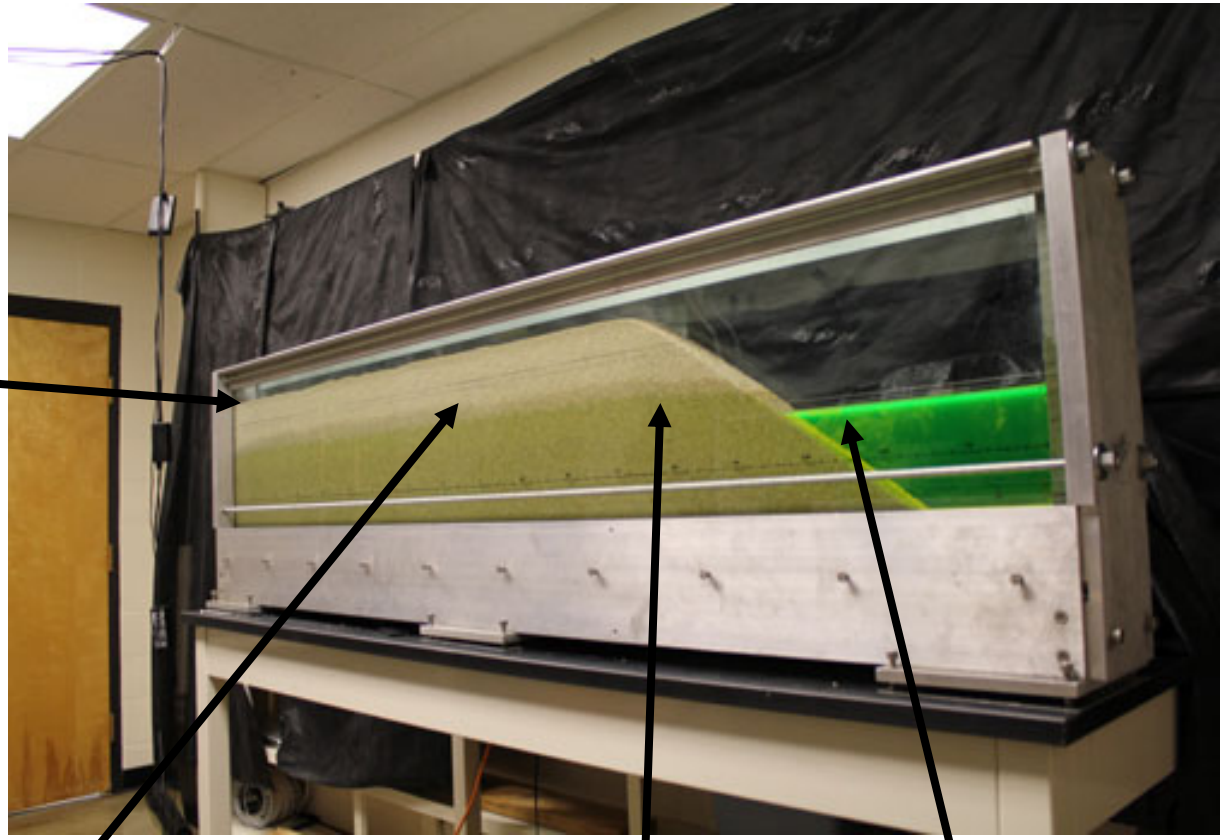
Methods

- Sand Tank Experiments



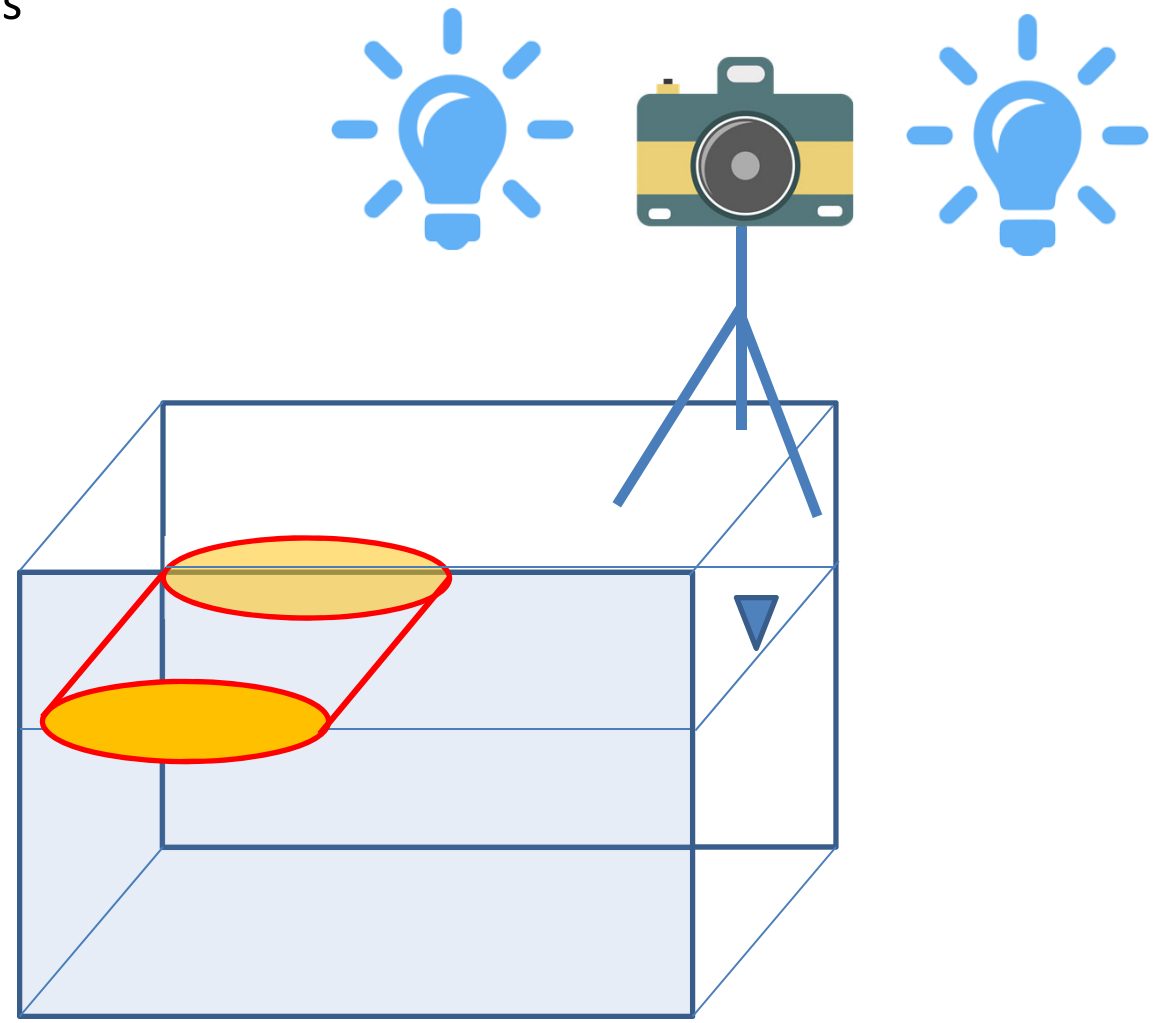
NAPL spill (+ fluorescent tracer)

Review: Sand Tank Experiments



Methods

- Sand Tank Experiments



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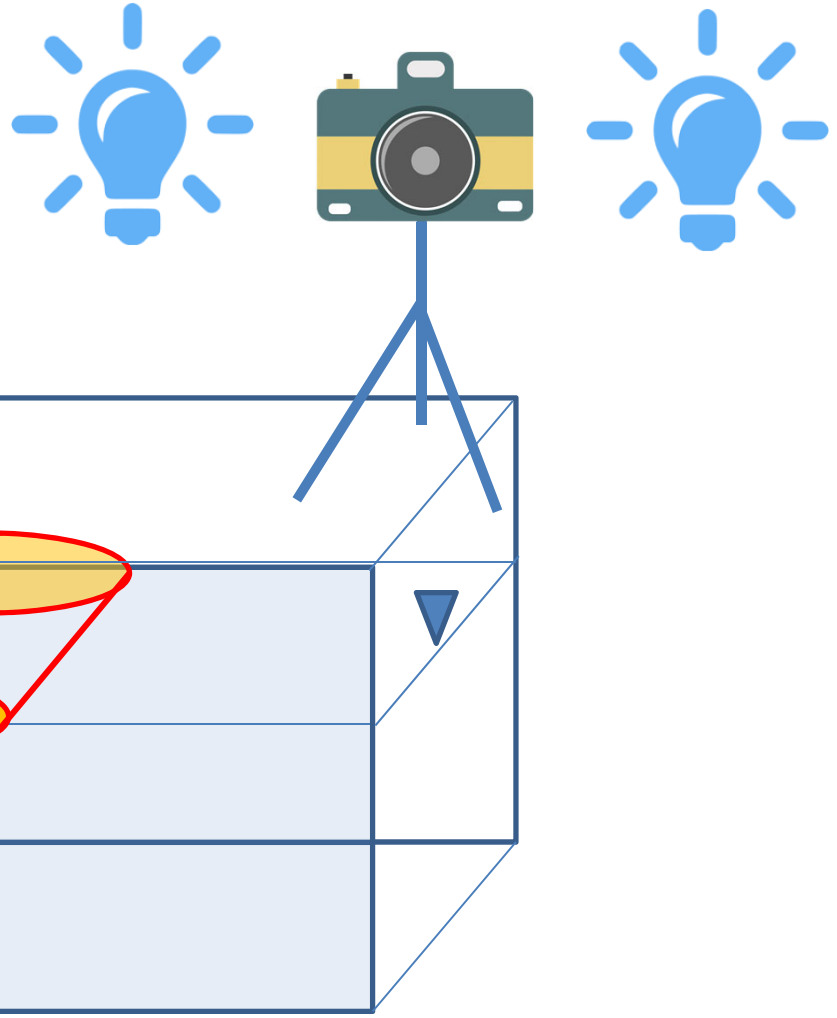
Methods

- Sand Tank Experiments

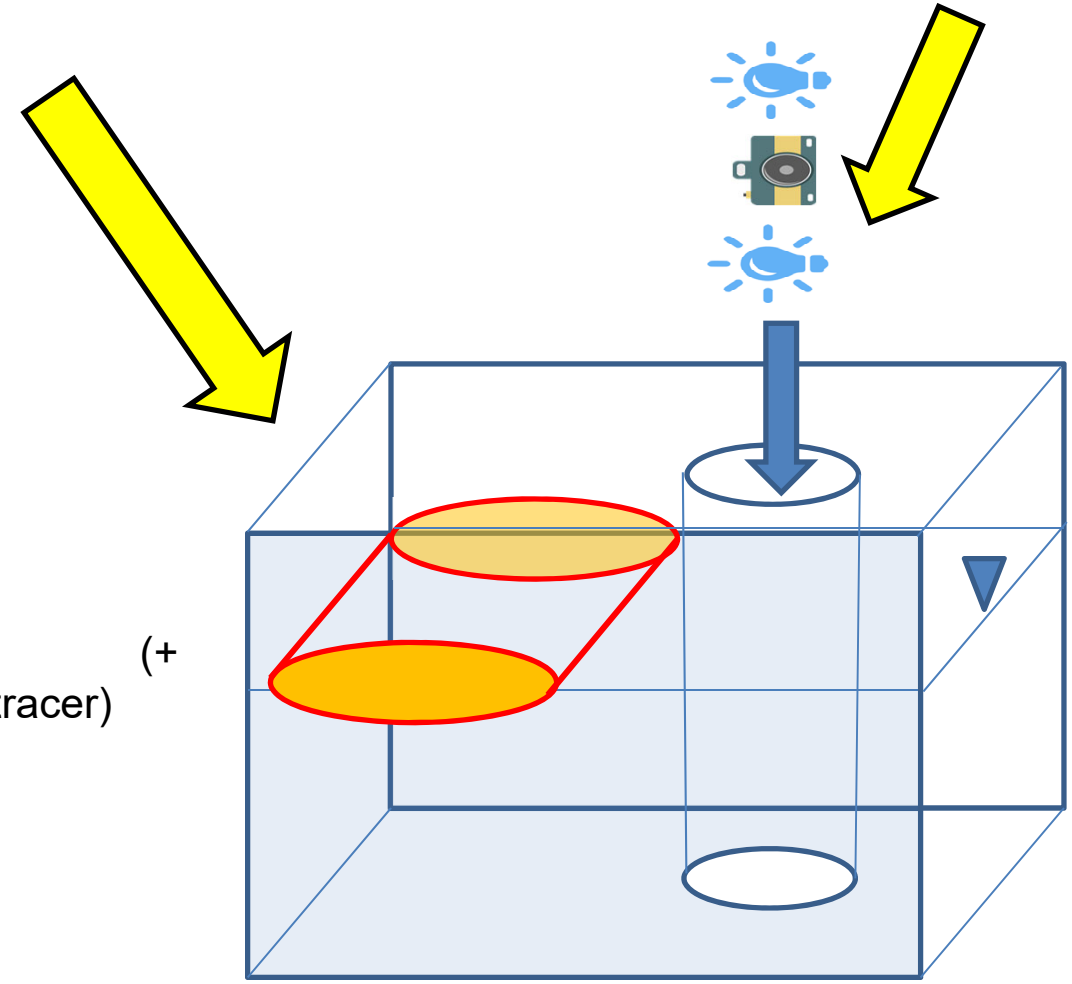


NAPL spill (+ fluorescent tracer)

Can the principles of Sand Tank Experiments be scaled so they could be implemented in the field?

Methods

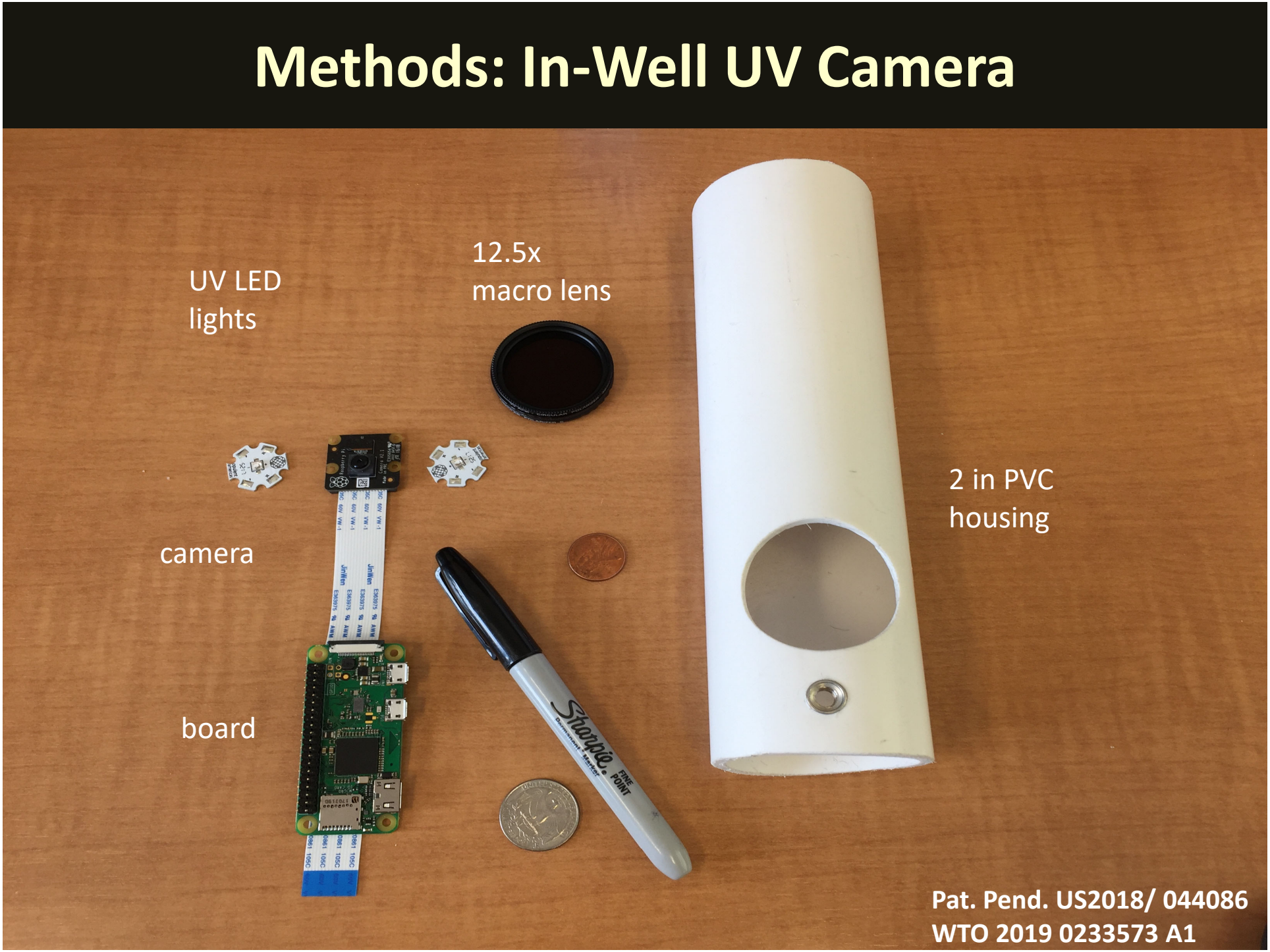
- Sand Tank Experiments
- In Well Experiments



NAPL spill (+ fluorescent tracer)

Can the principles of Sand Tank Experiments be scaled so they could be implemented in the field?

Methods: In-Well UV Camera



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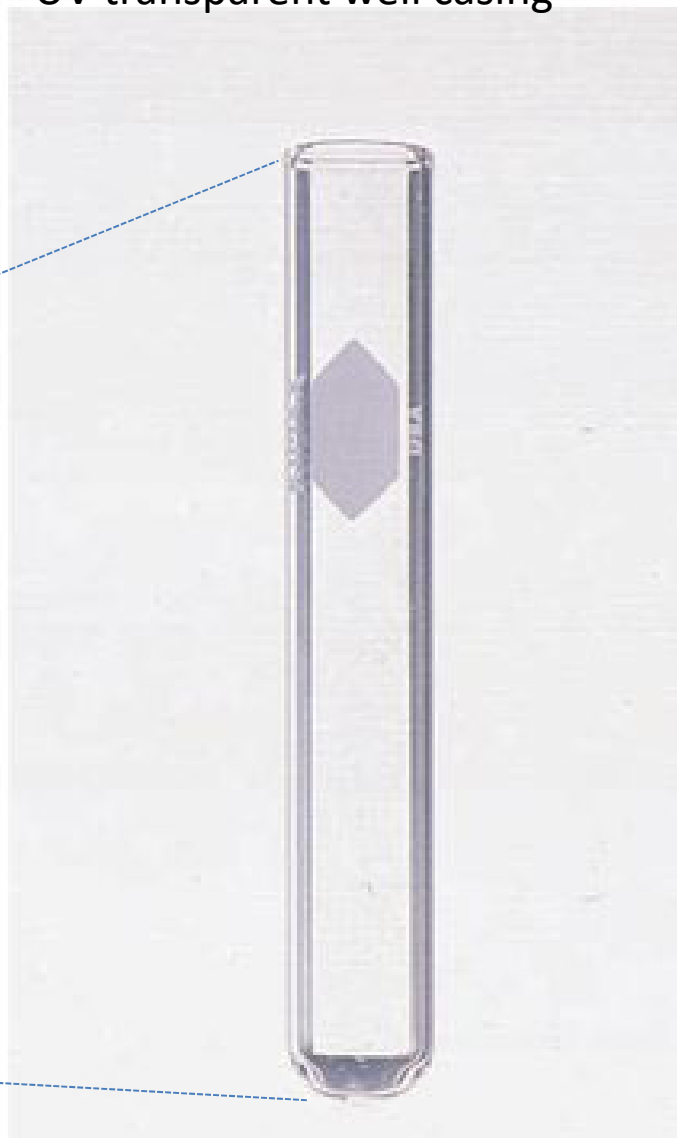
Methods: In-Well UV Camera

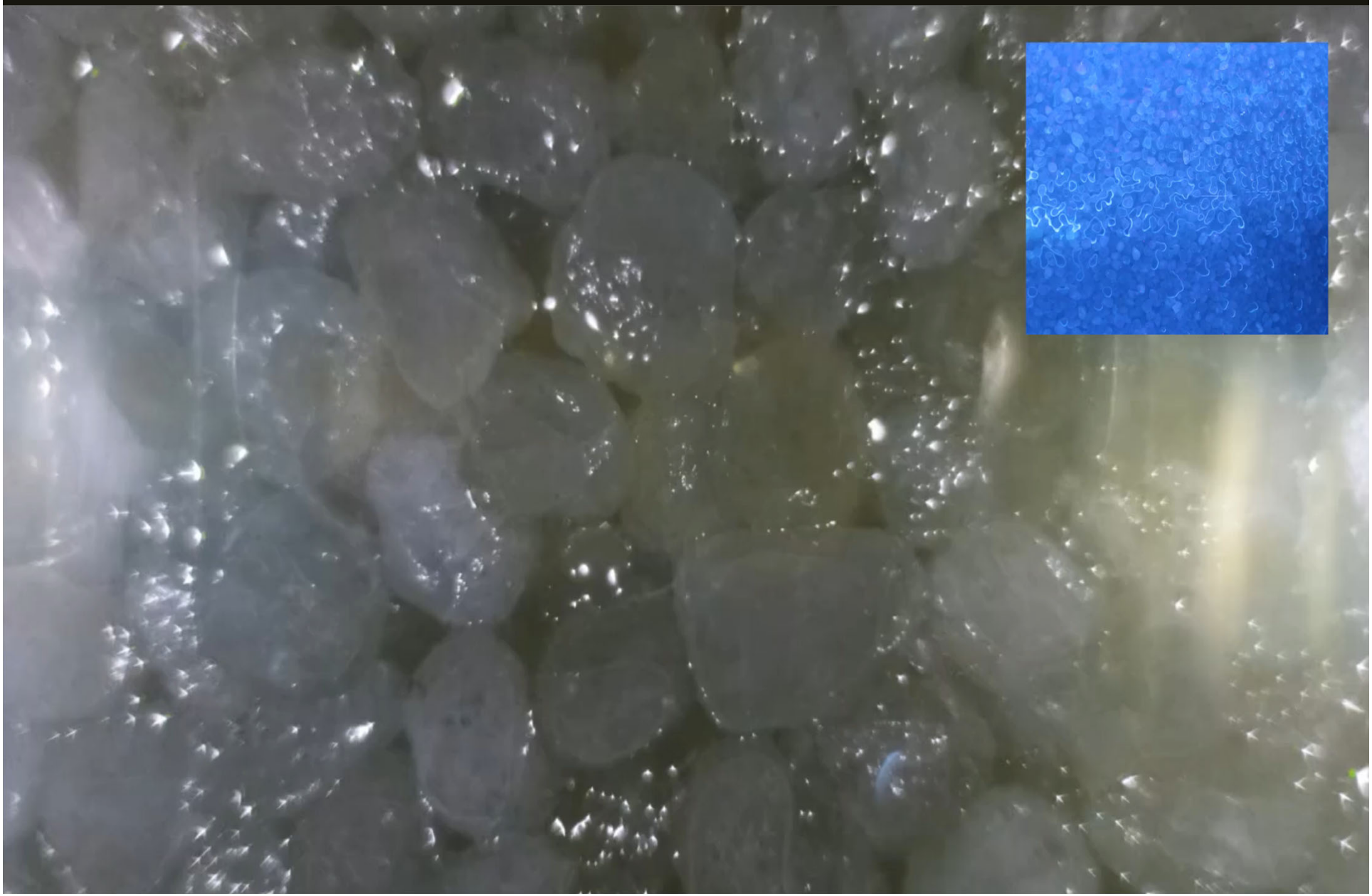
UV transparent well casing



Small tank experiments: diesel

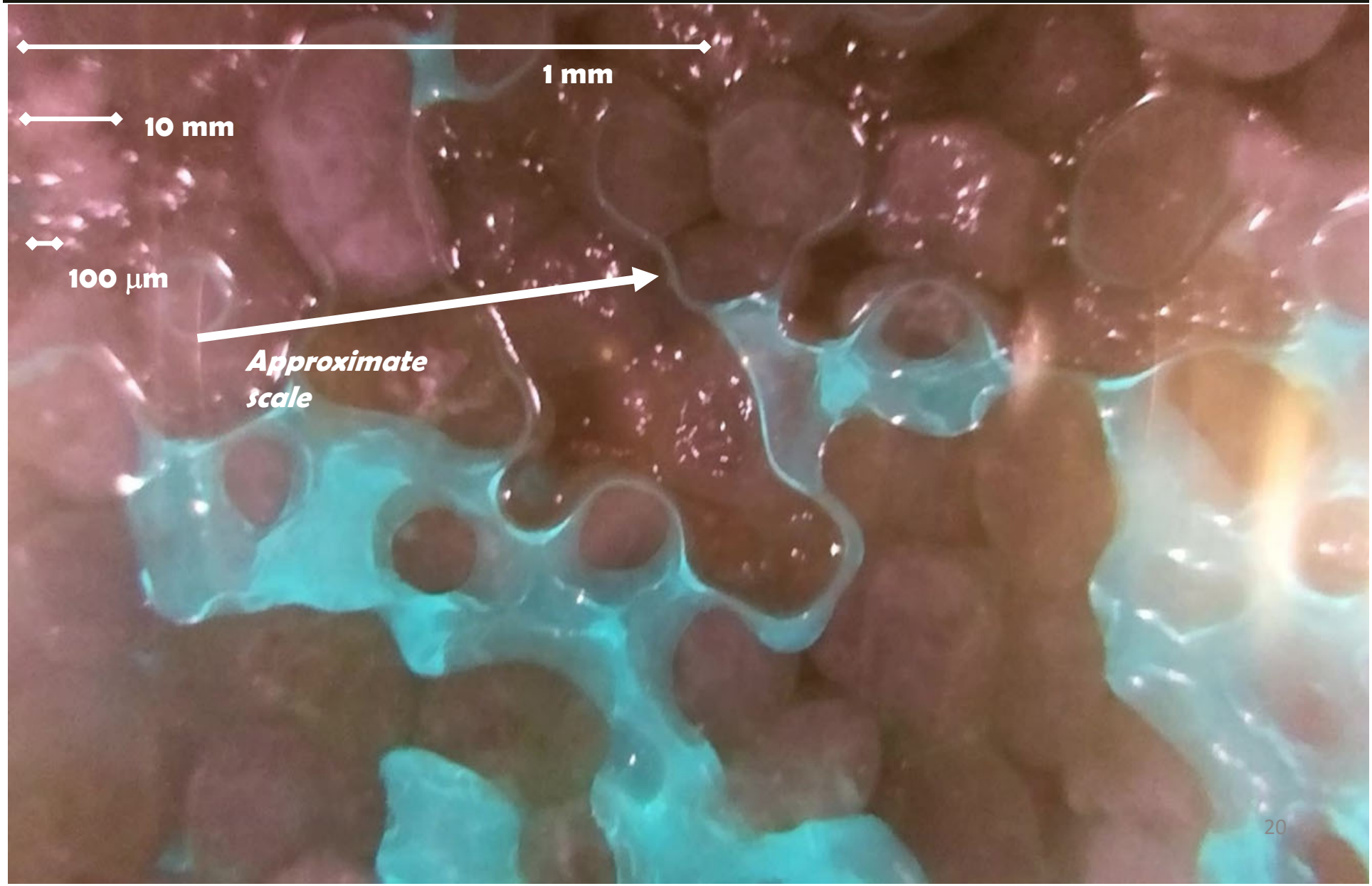
Results: Outer View of Sand Tank w/Diesel

Results: Diesel (stationary In Well Camera)

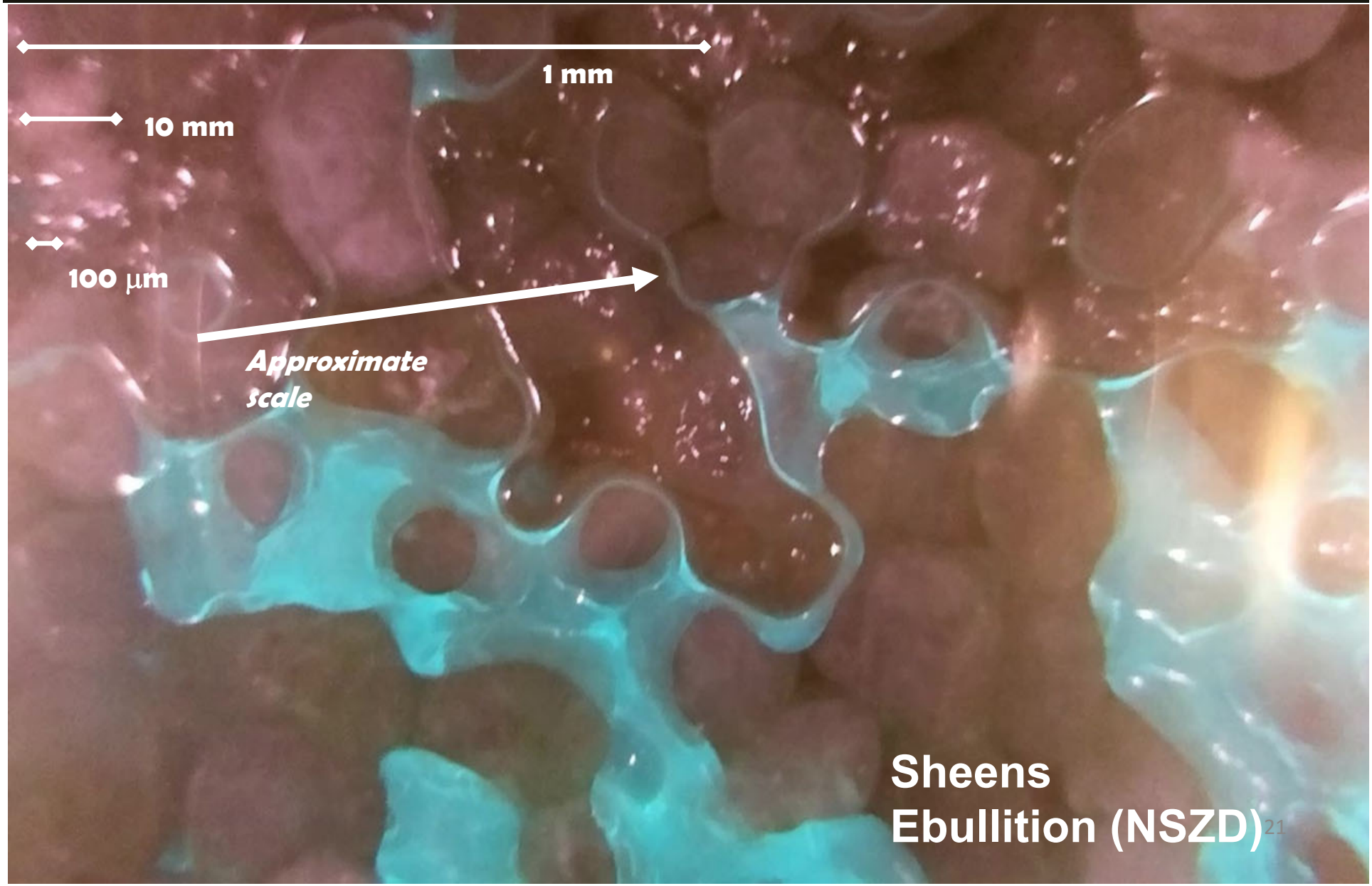


In Well, Diesel: Dropping the In Well Camera

In Well: Diesel Zoom-In Highlights



In Well: Diesel Zoom-In Highlights



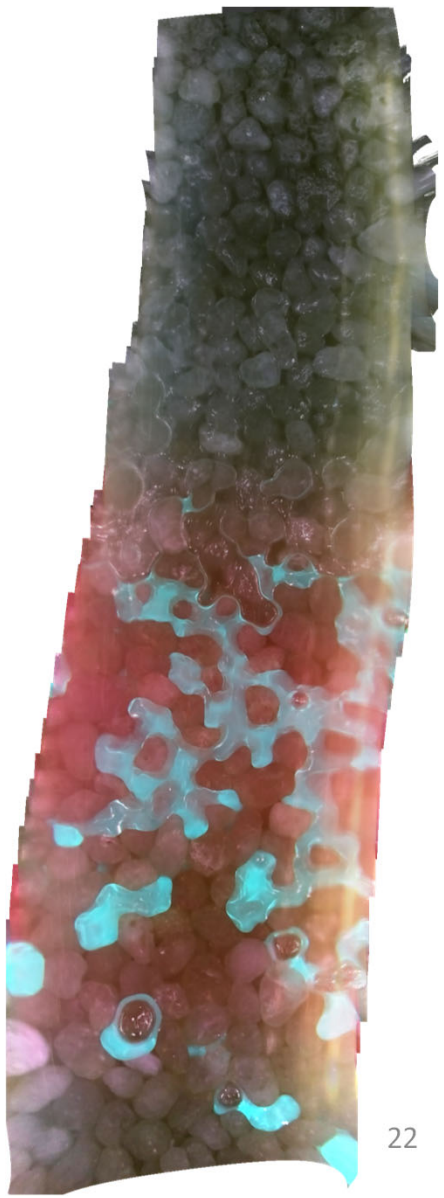
In Well: Dropping the iWUC

video

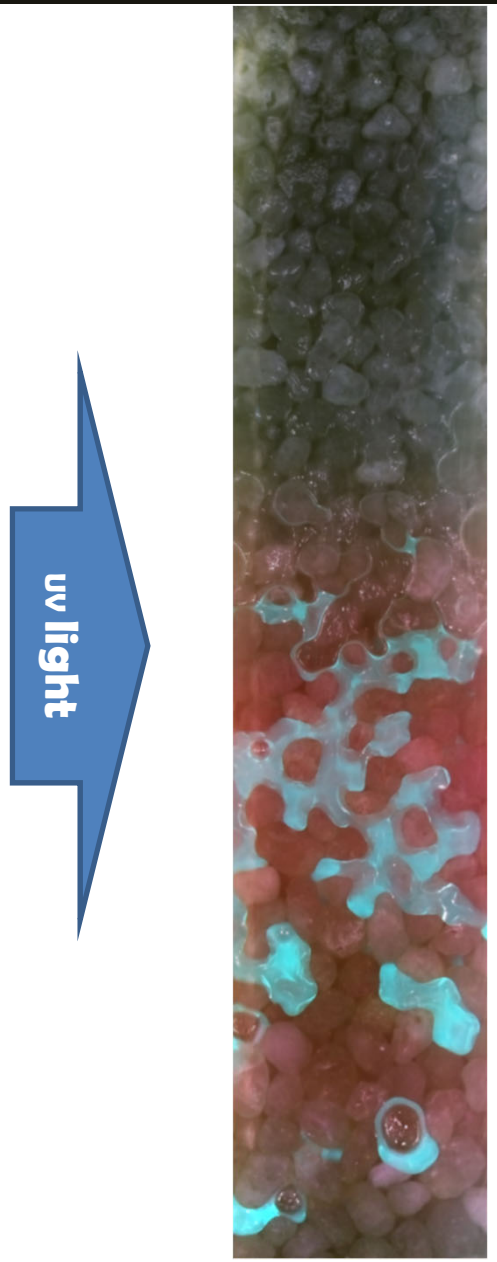
panoramic

~4 in

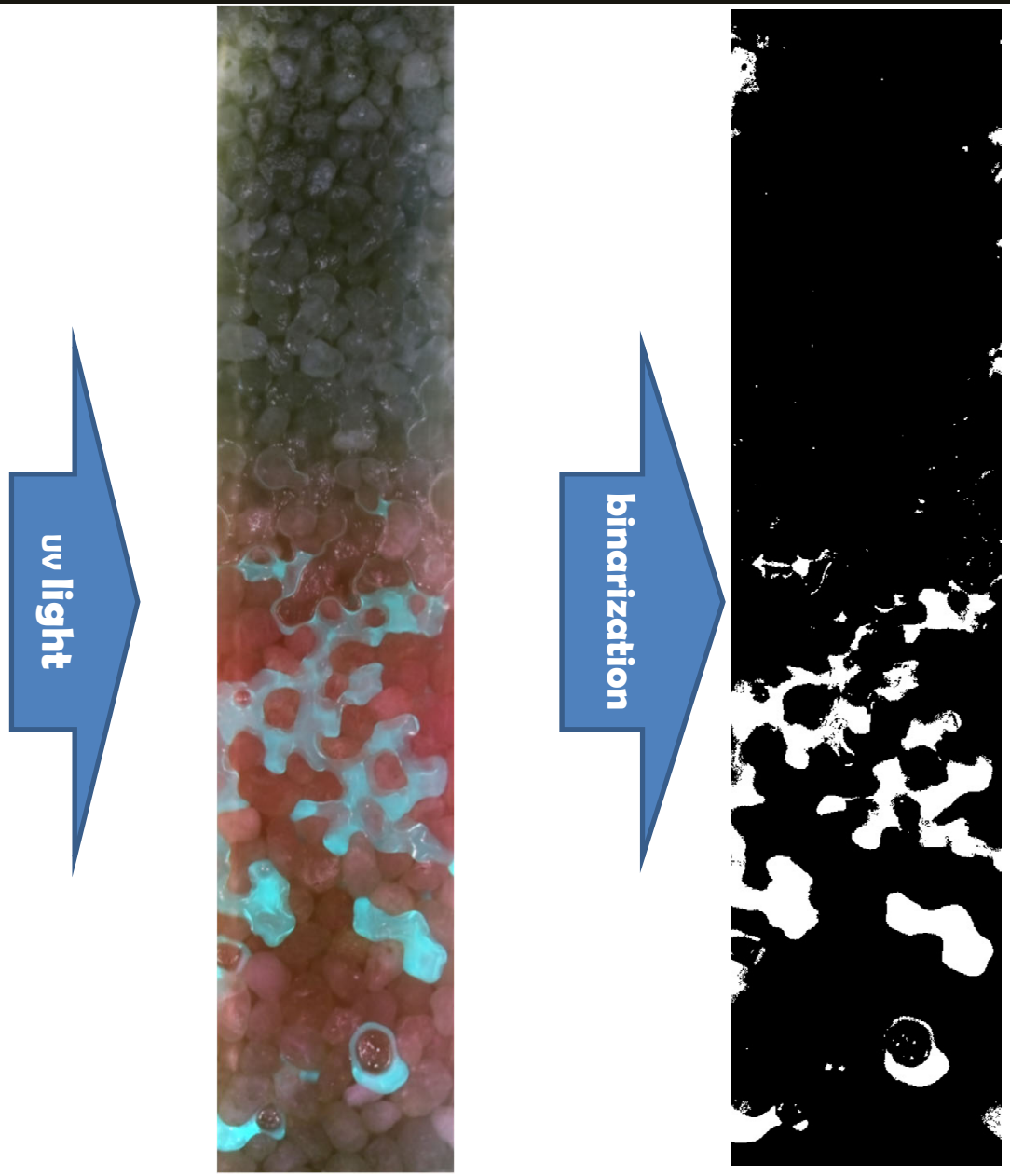
~1 in



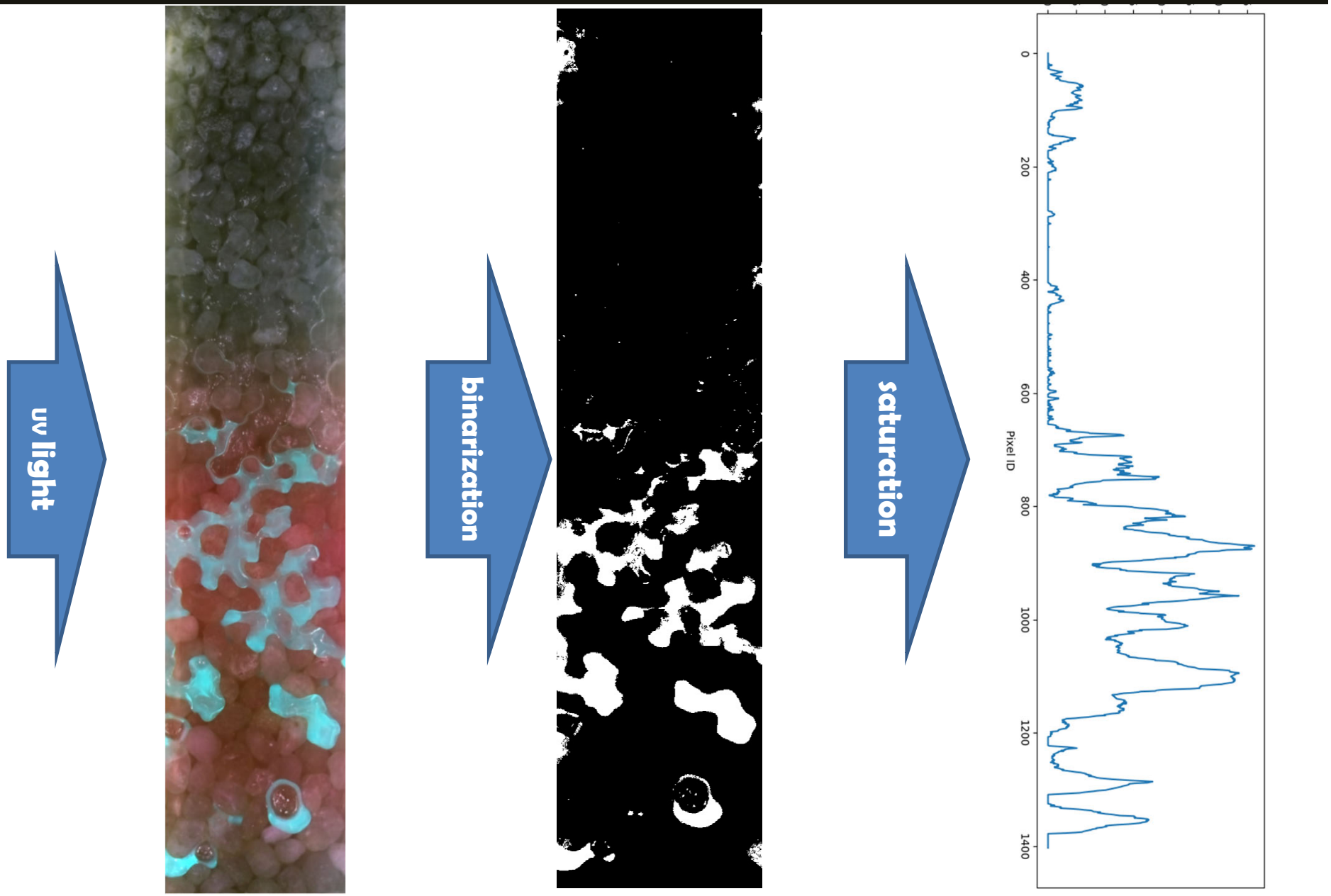
In Well: From digital images to saturation estimates



In Well: From digital images to saturation estimates

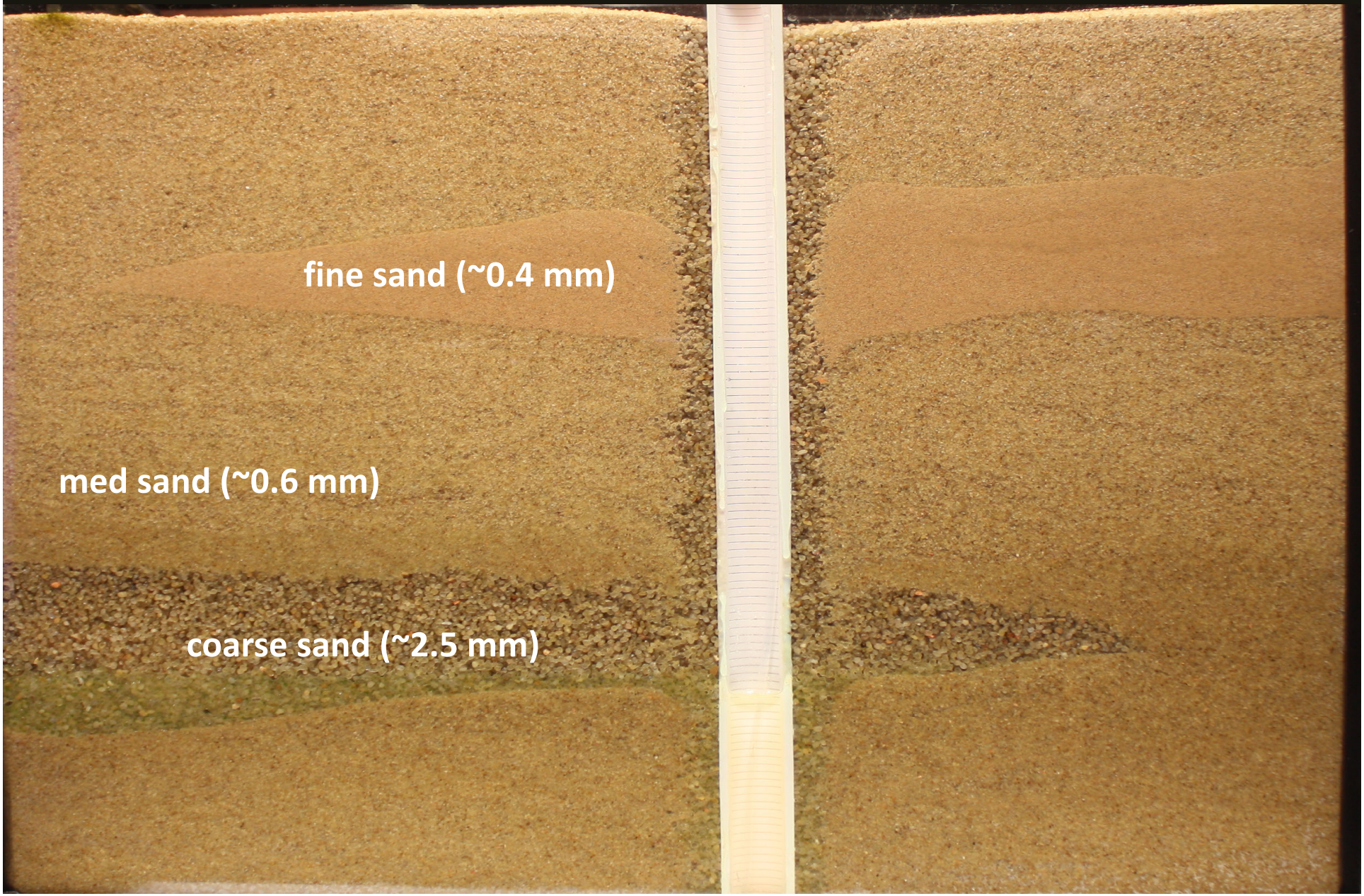


In Well: From digital images to saturation estimates

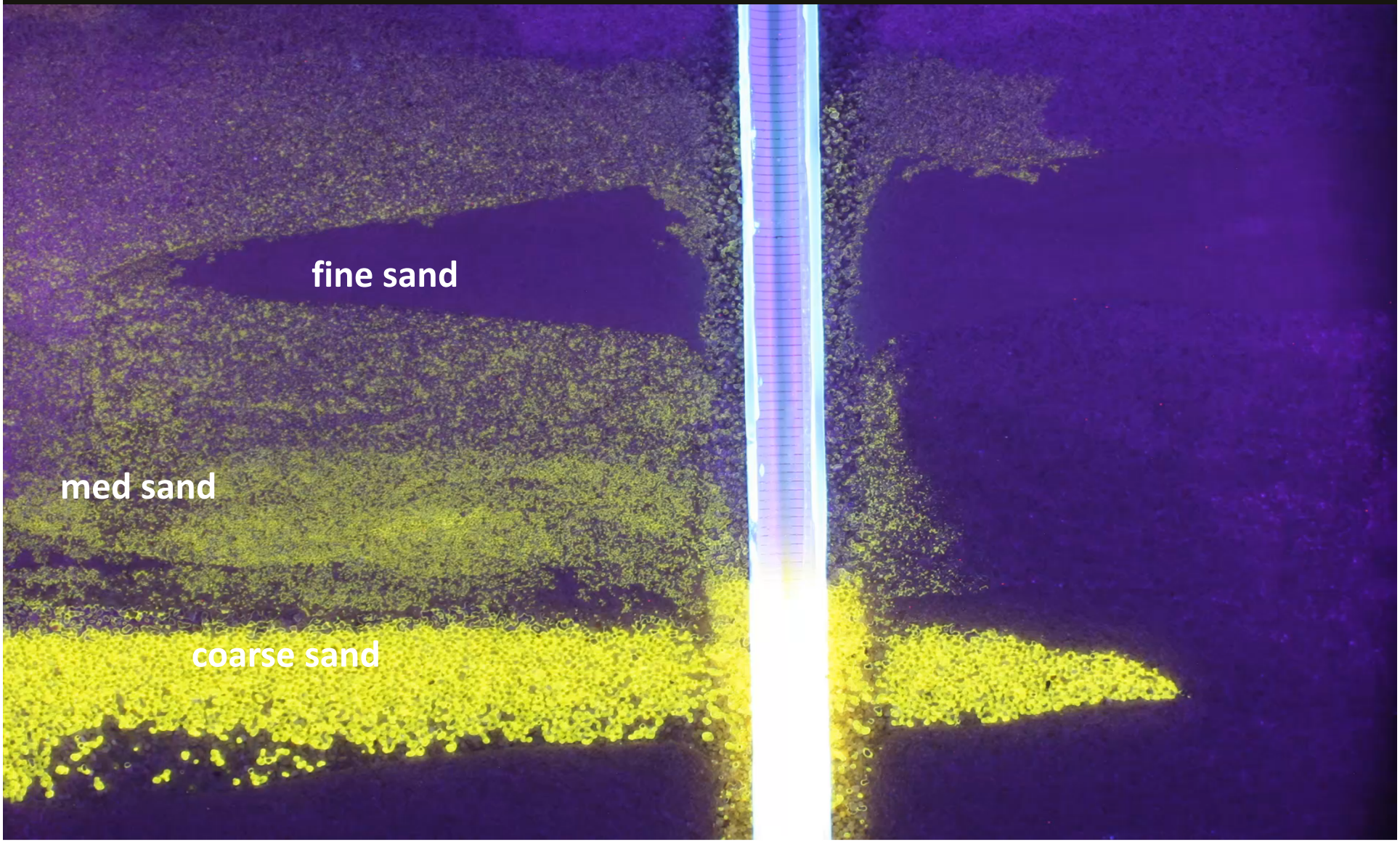


Medium tank experiments: dyed baby oil

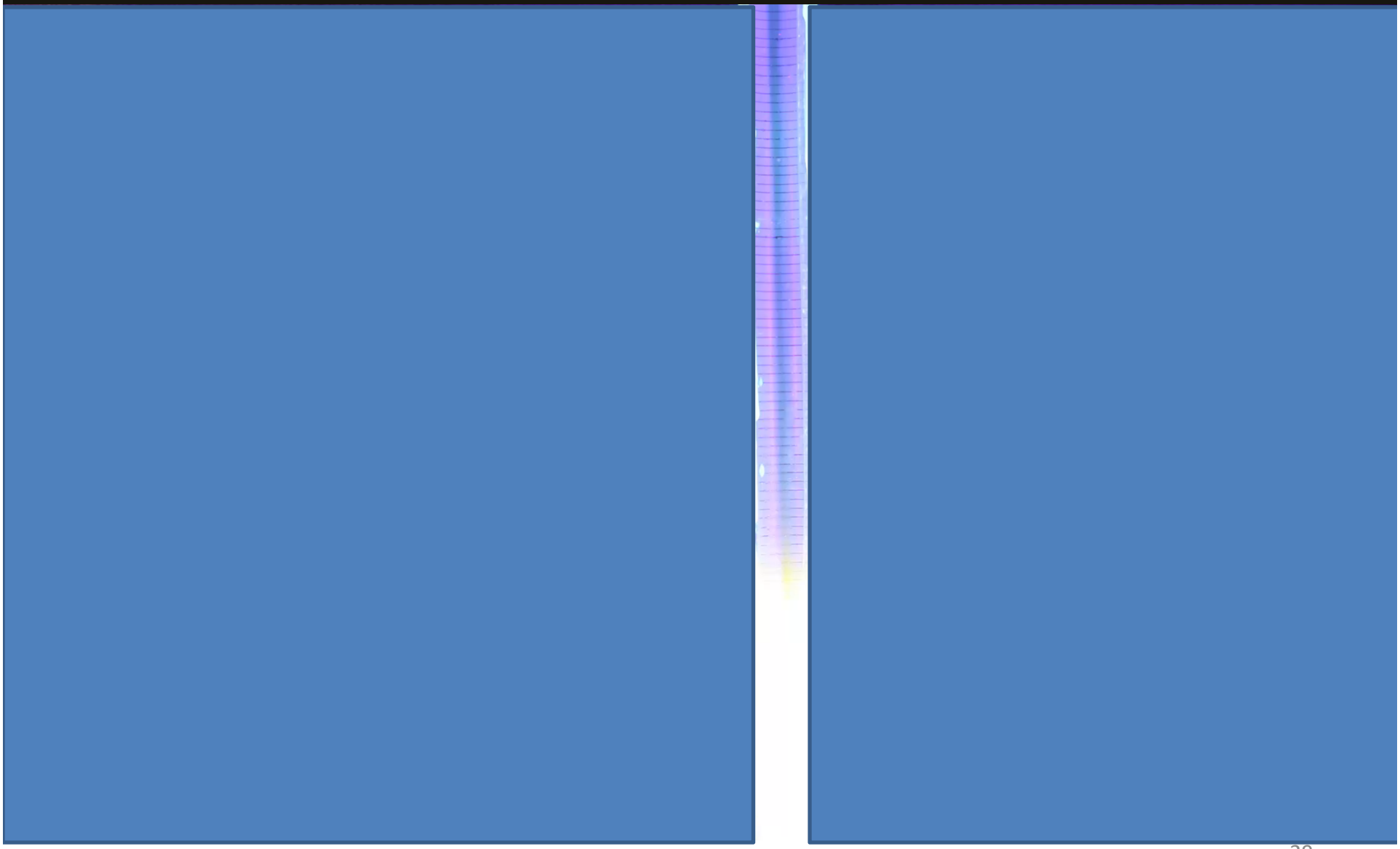
Large Tank, Layered Soil, Baby Oil, Outside



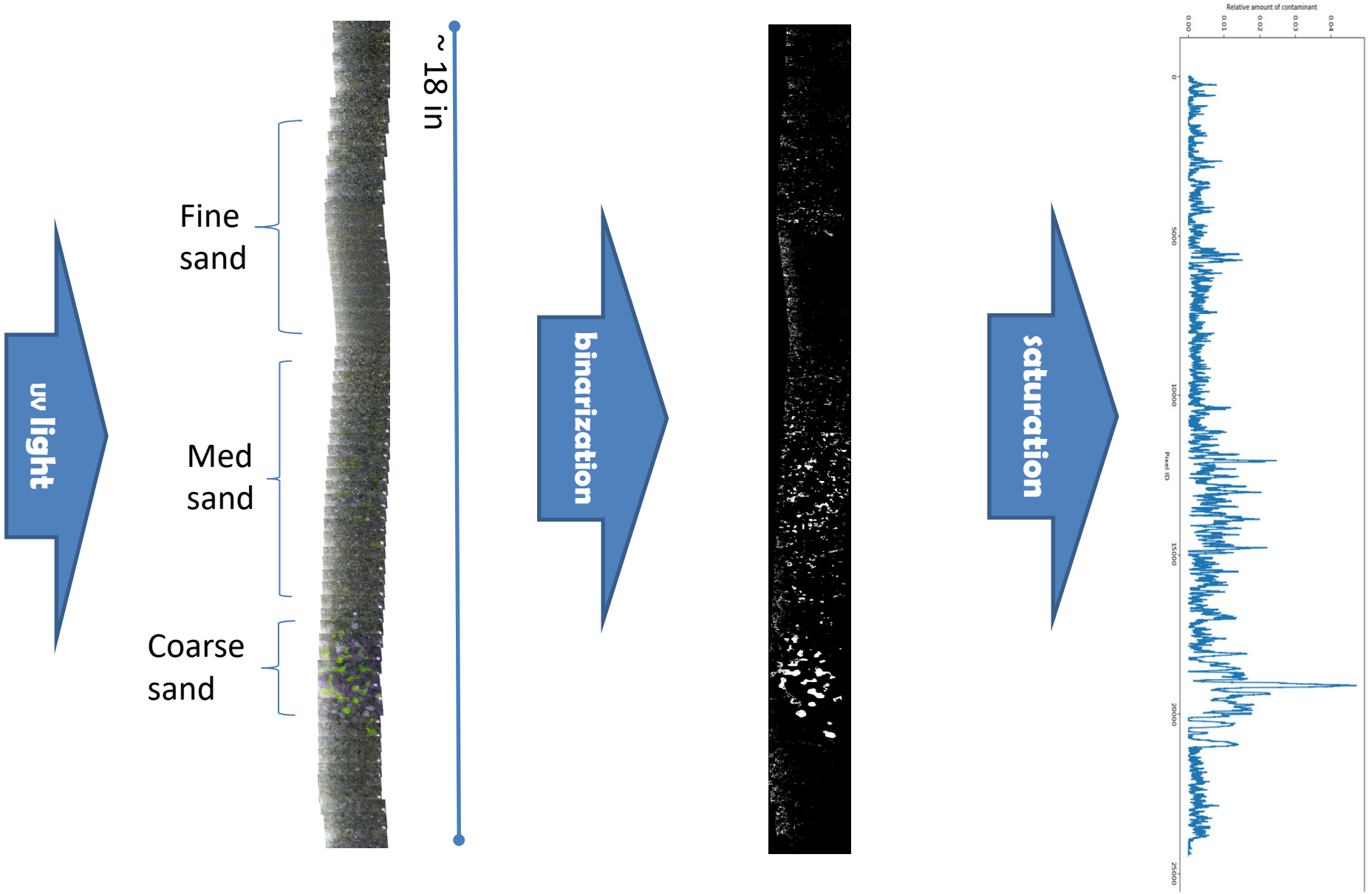
Results: Outer View of Sand Tank, Layered



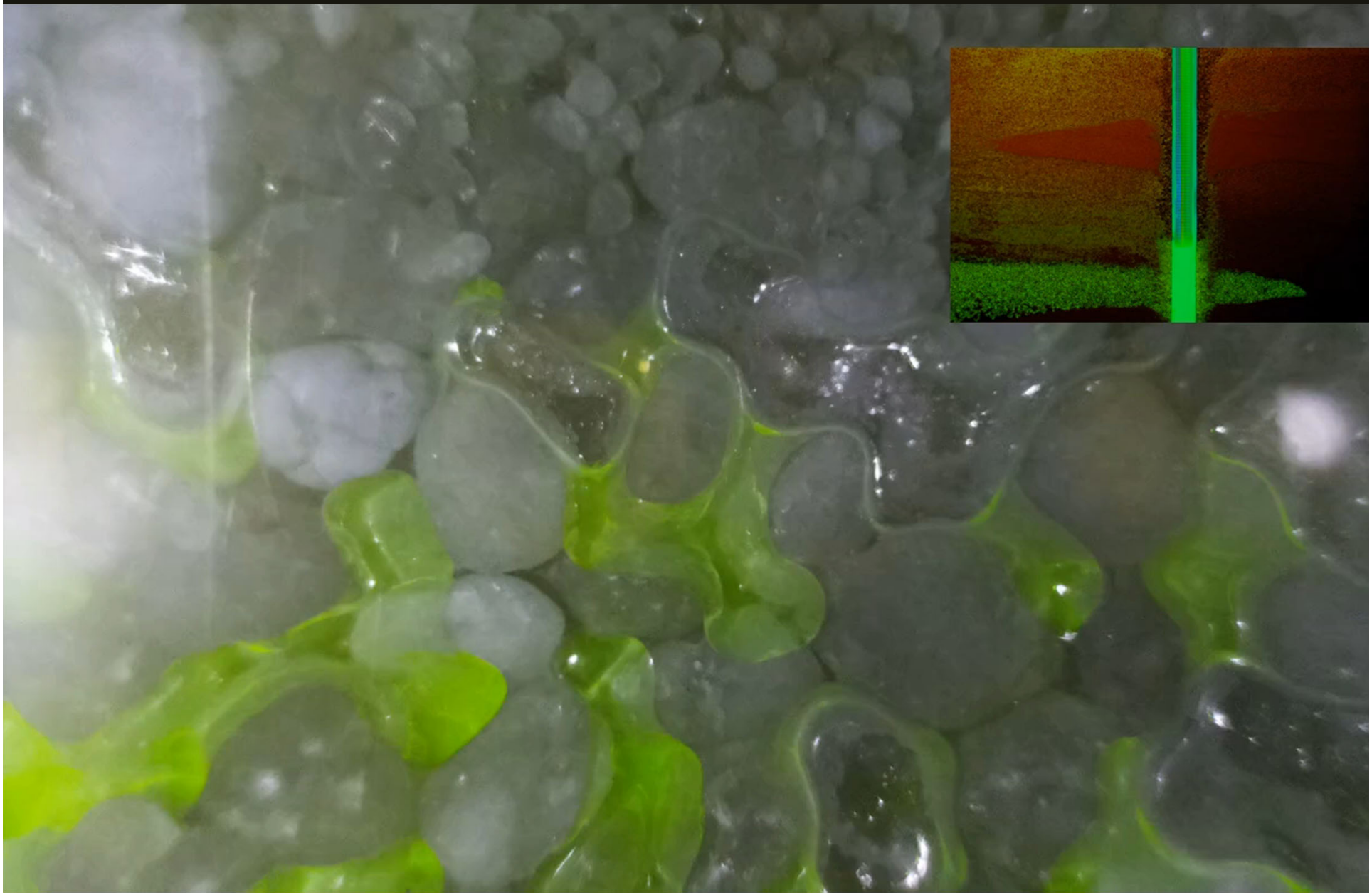
Results: Outer View of Sand Tank, Layered



In Well Camera: Vertical Survey



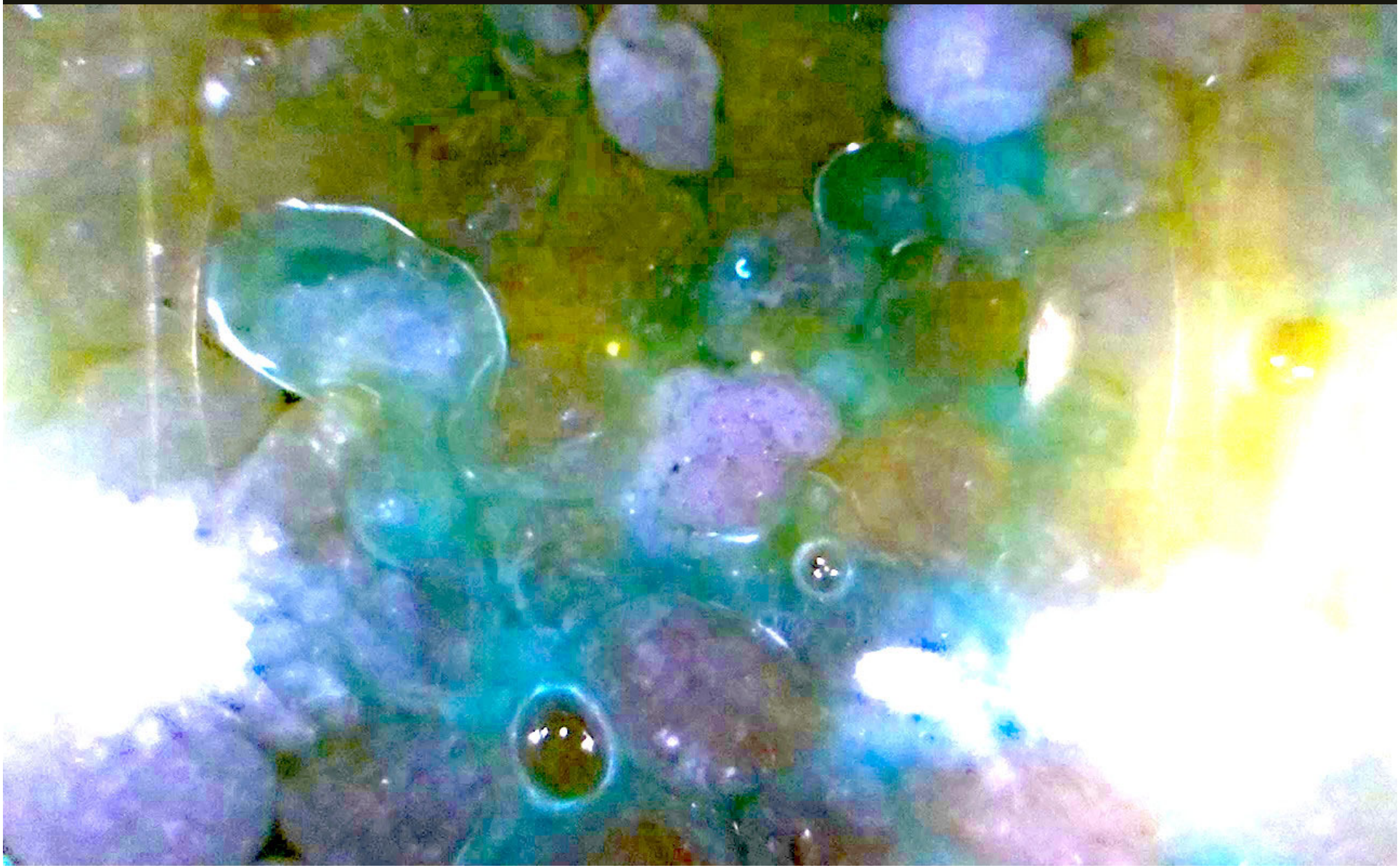
In Well Camera: Water Table Fluctuations



Contaminants

- Baby oil with fluorescent dye
- Diesel
- Gasoline
- Others?

Other Contaminants (Gasoline) In Well Camera



Limitations

- Inherent contaminant fluorescence
- Well casing materials
- Well casing installation
- Well packing Vs. formation collapse

Final Thoughts

- Very early prototype in order to improve time resolution of HRSC UV based technologies
- Pics shown, but other techniques may have higher sensitivity
- Lots of work ahead…

Final Thoughts

- Very early prototype in order to improve time resolution of HRSC UV based technologies
- Pics shown, but other techniques may have higher sensitivity
- Lots of

Credits

- Photos within tank: Jenna DiMarzio and Justin Walton
- Photos on outside of tank wall: Jenna DiMarzio
- Photo editing: Gabriel Rodriguez
- Hardware design: Justin Walton, Wes Taylor
- Video editing: Justin Walton, Gabriel Rodriguez