Analysis of Airborne Lidar Bathymetry (ALB) Bottom Return waveforms for seafloor characterization

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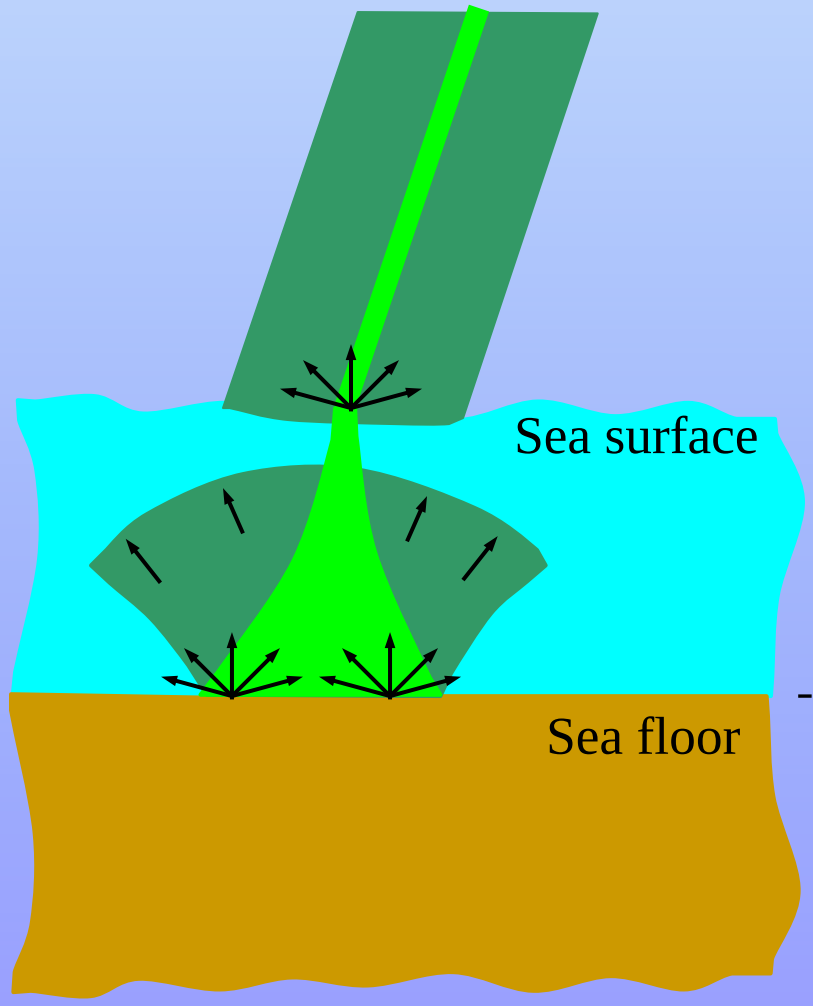
JALBTCX 2016

Silver Spring, MD

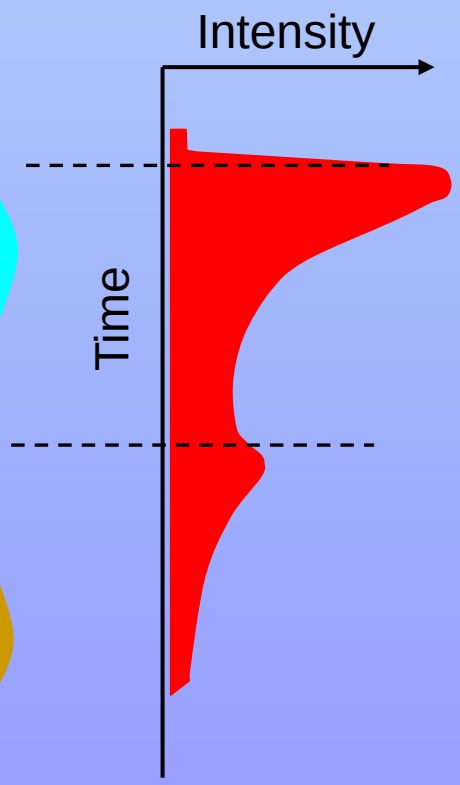
Outline

Bottom return characteristics → Seafloor characterization → ALB uncertainties

Laser pulse geometry: Green (532nm)



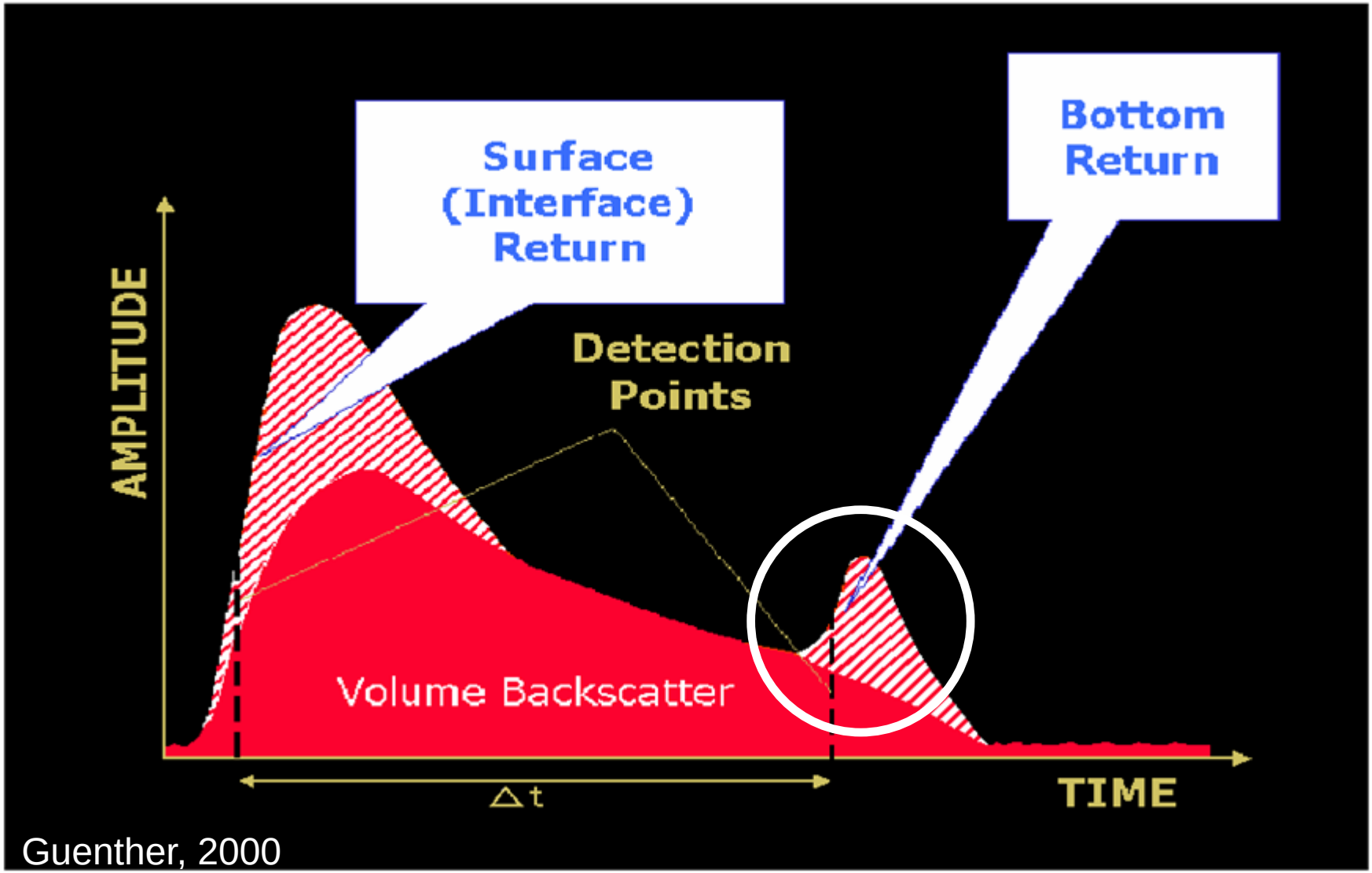
Waveform
(function of time)



Speed of light (C):

<u>Air</u>
1 ns = 30 cm
<u>Underwater</u>
1 ns = 22. 5 cm

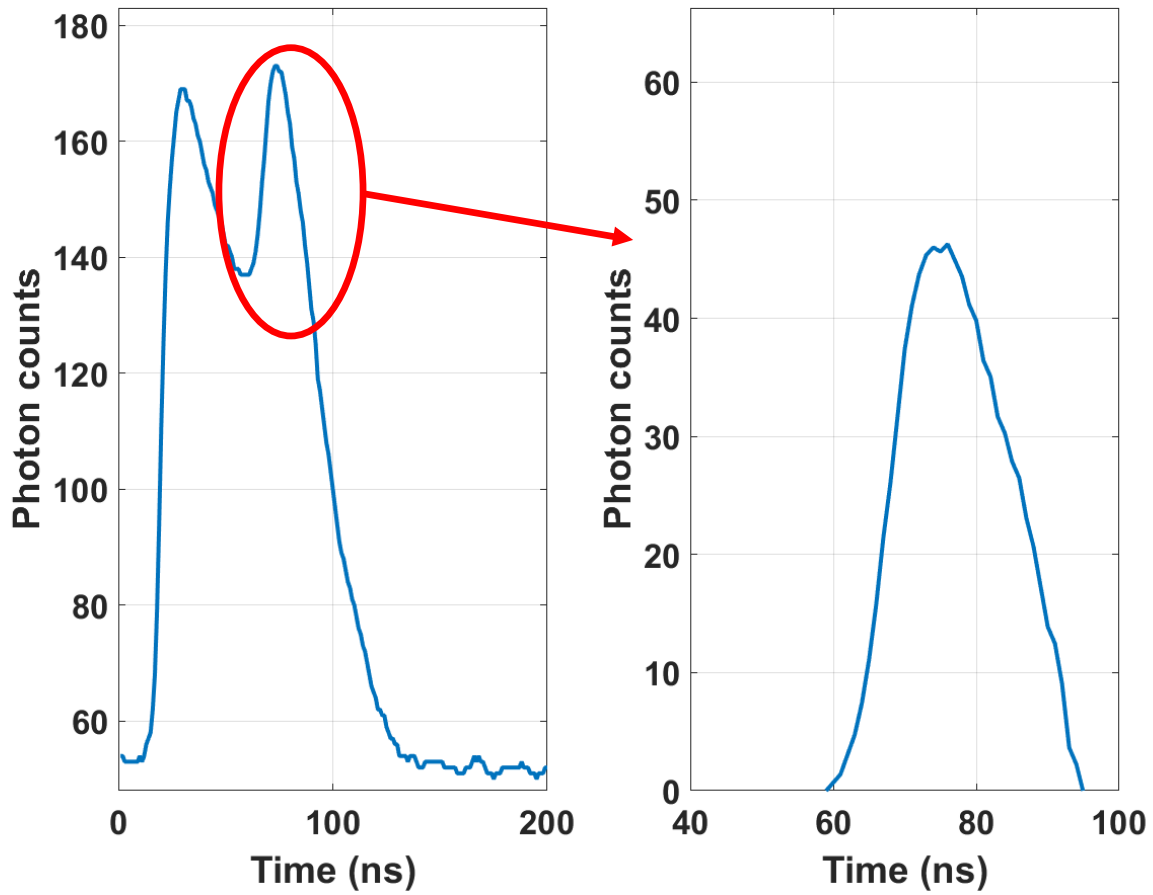
Conceptual Green Waveform



Guenther, 2000

Waveforms for different bottom textures

Case 1: Sandy bottom

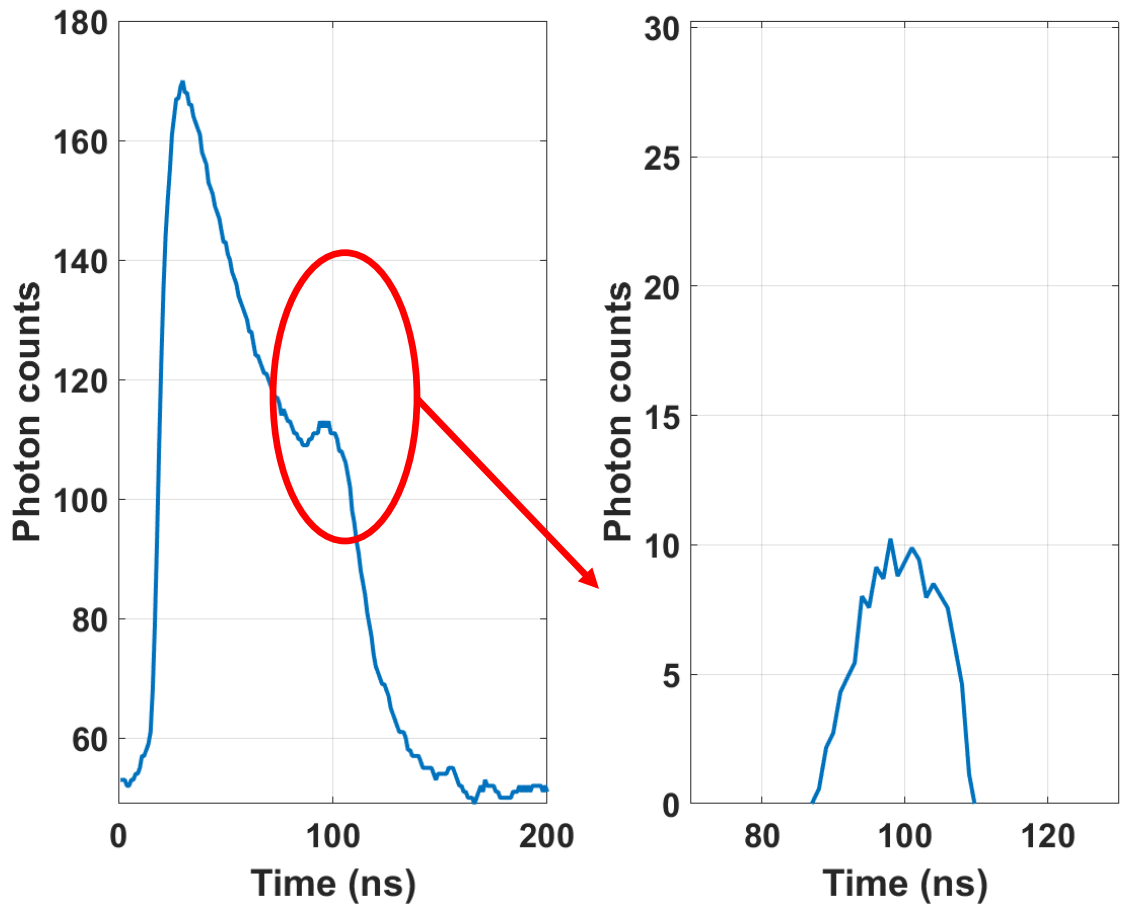


JALBTCX 2011, (Pe'eri et al.)

SHOALS-1000 waveform

Waveforms for different bottom textures

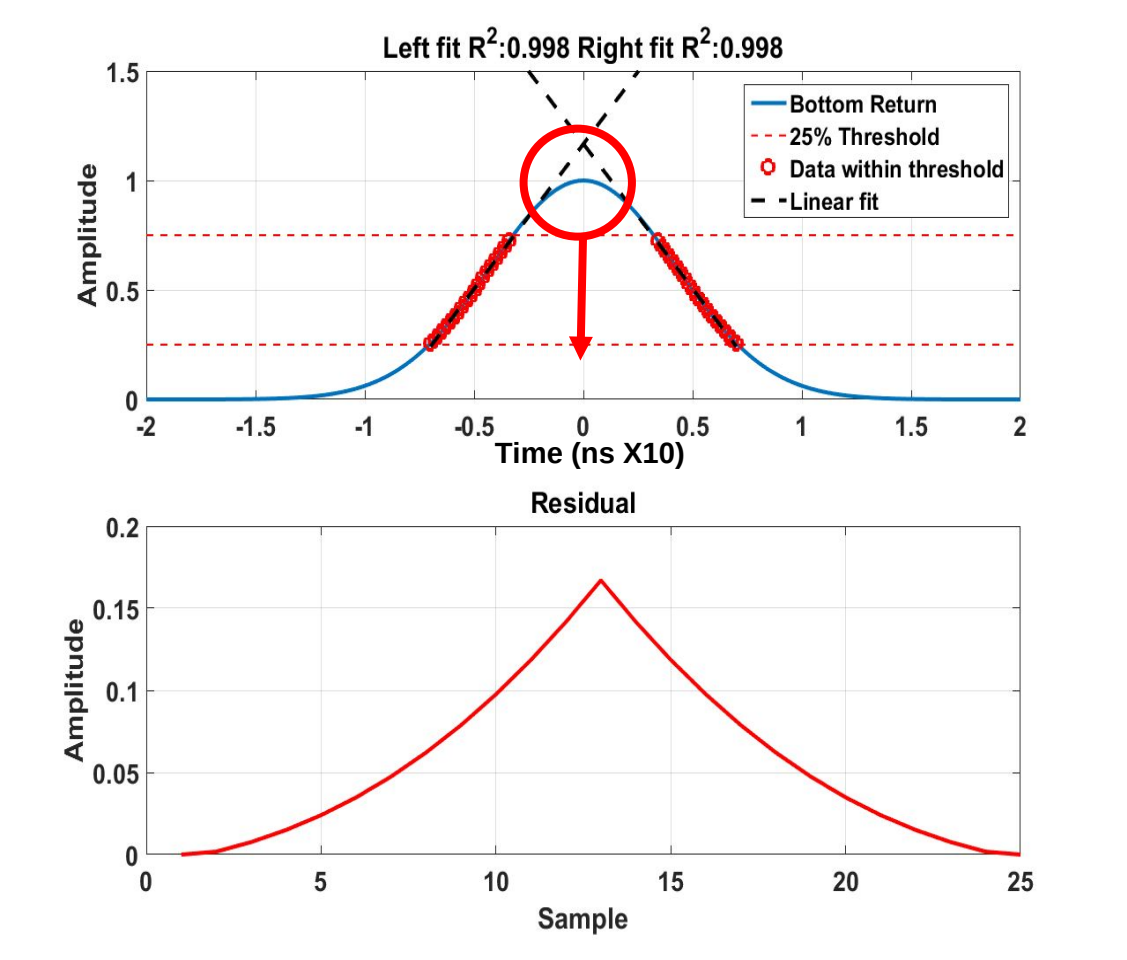
Case 2: Gravel to cobble bottom



JALBTCX 2011, (Pe'eri et al.)

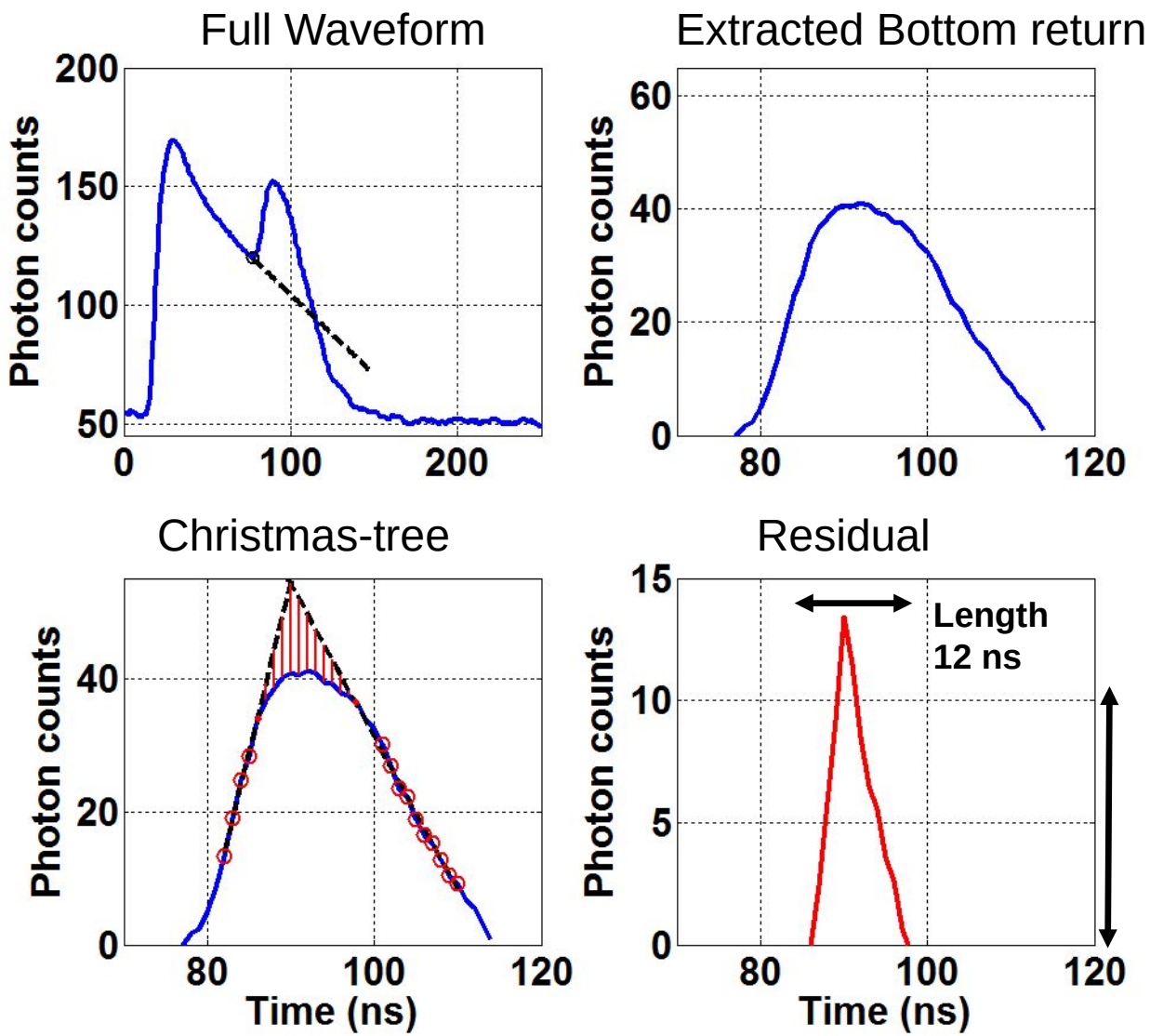
SHOALS-1000 waveform

ALB Bottom return analysis



Christmas tree signature!

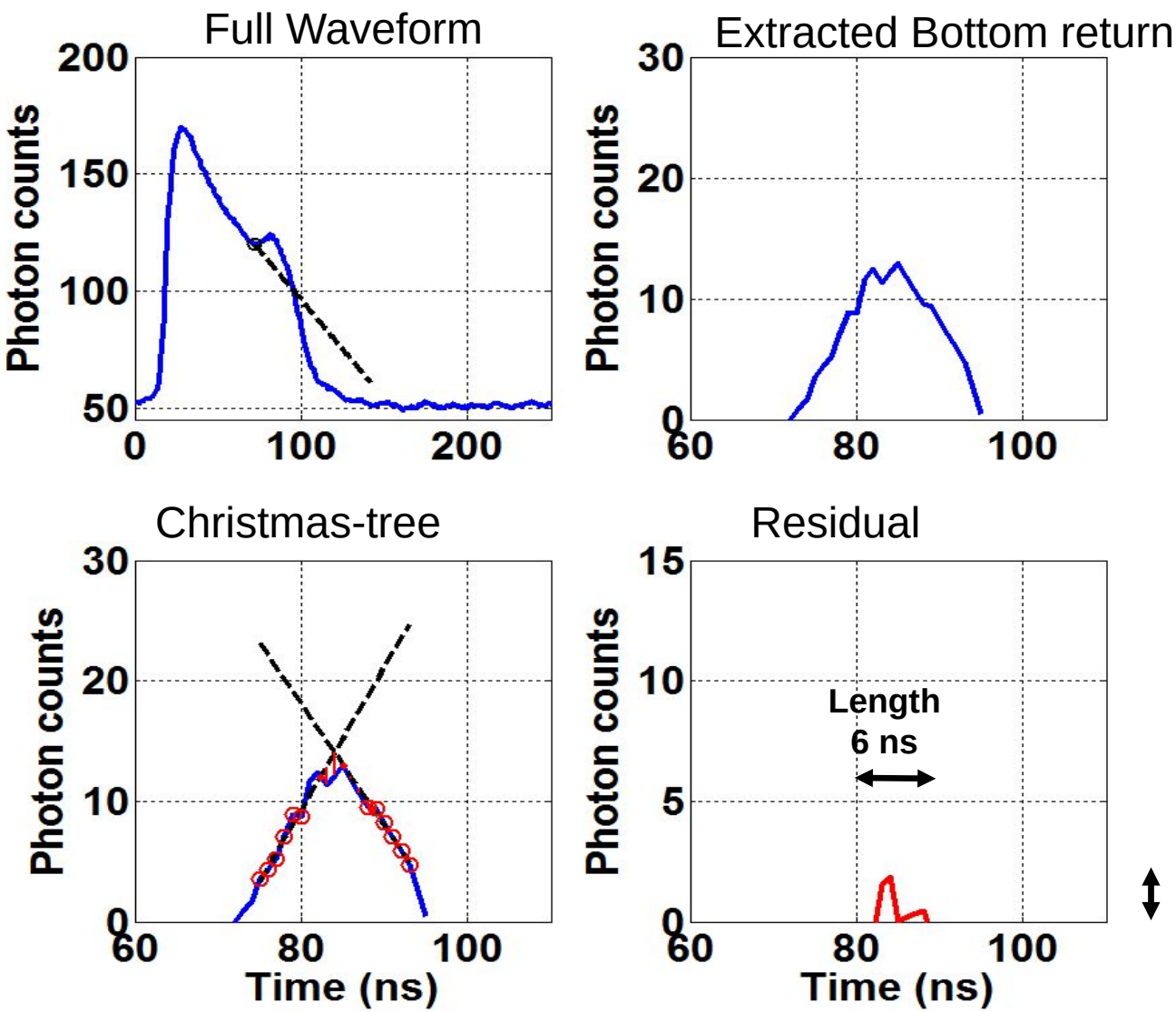
ALB waveforms: Sand

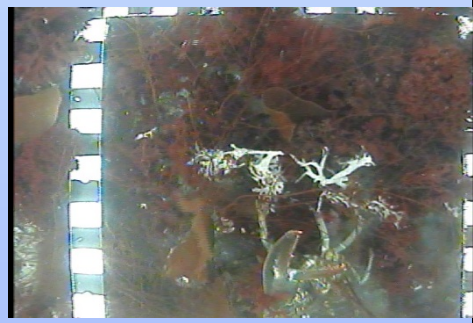


JALBTCX 2011, (Pe'eri et al.)

Amplitude=13 PC

ALB waveforms: Seaweed



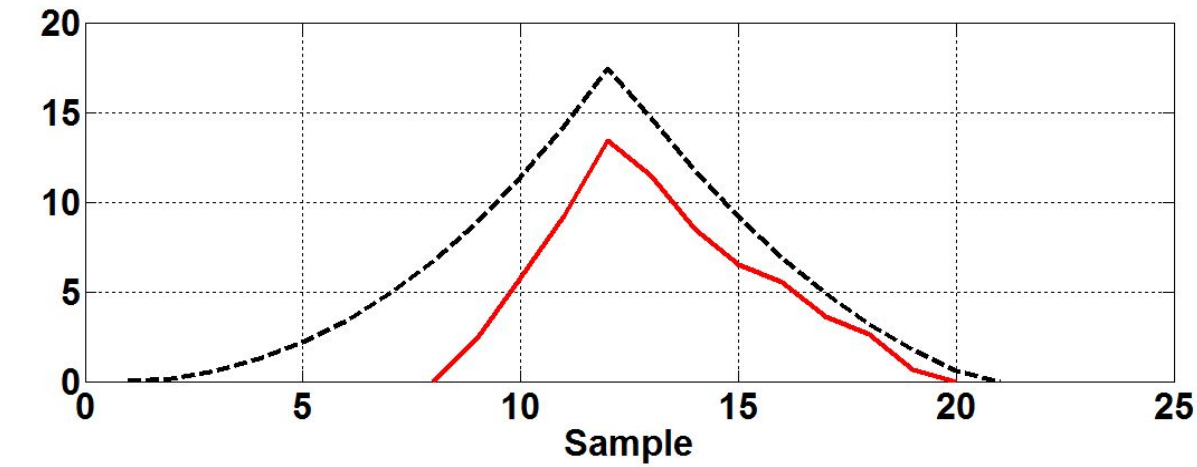


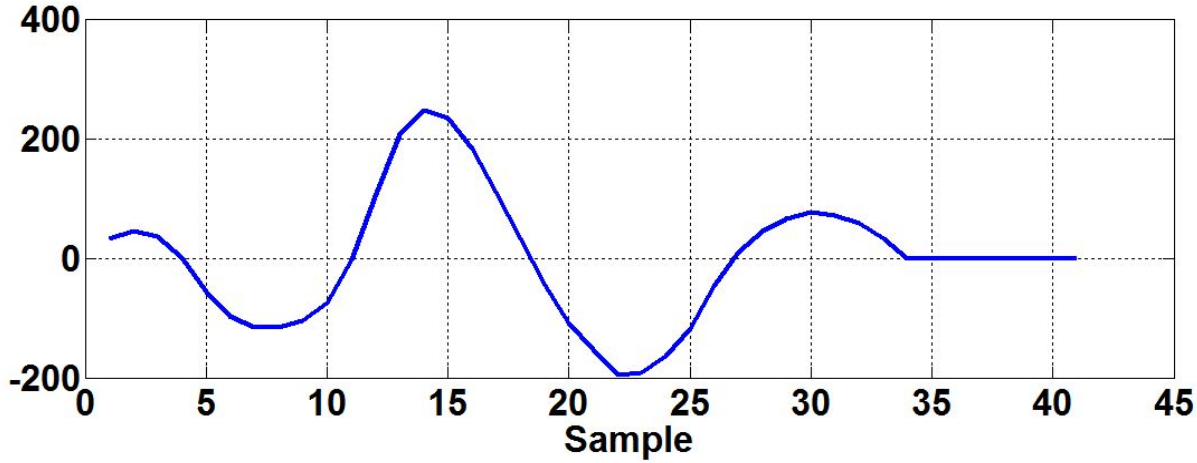
JALBTCX 2011, (Pe'eri et al.)

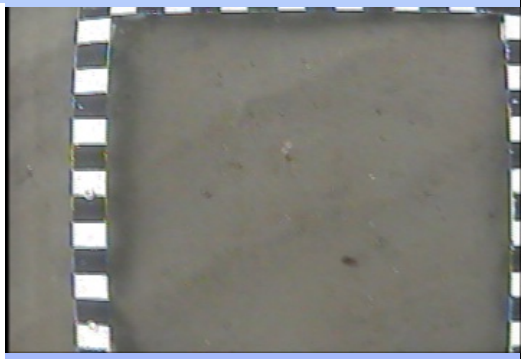
Amplitude=2 PC

Classification variable Cross-covariance

Sand



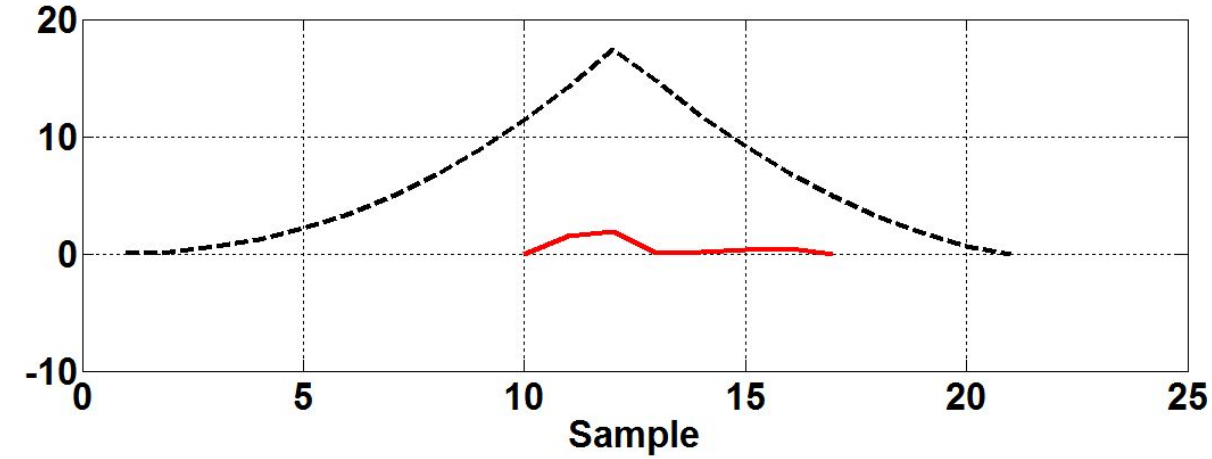


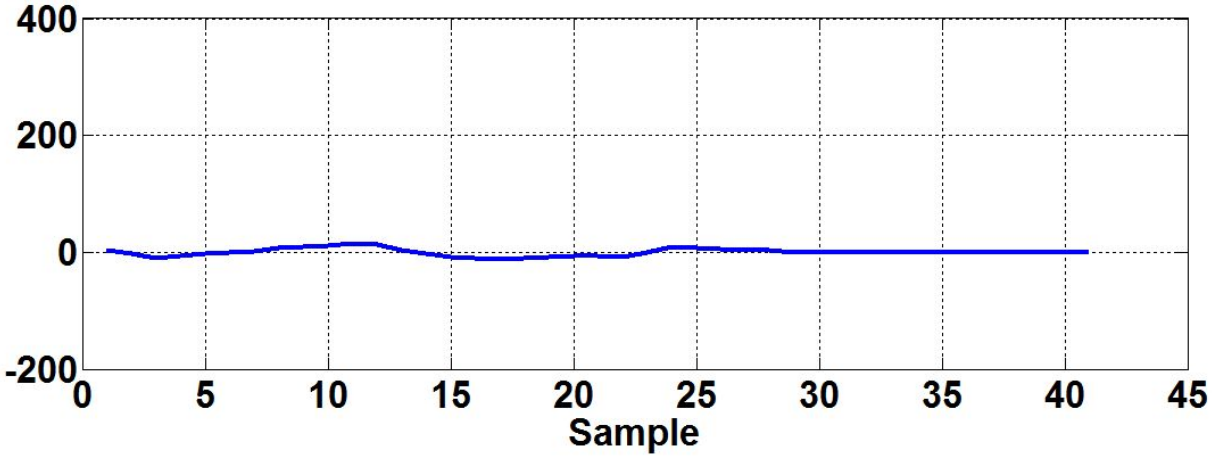


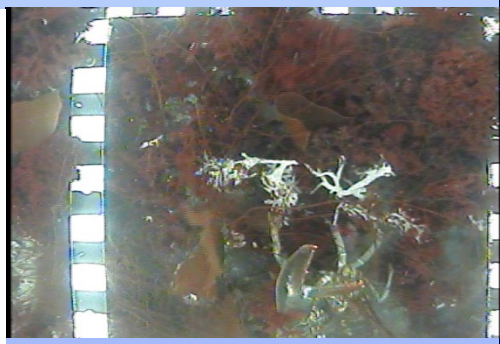
JALBTCX 2011, (Pe'eri et al.)

Classification variable Cross-covariance

Seaweed

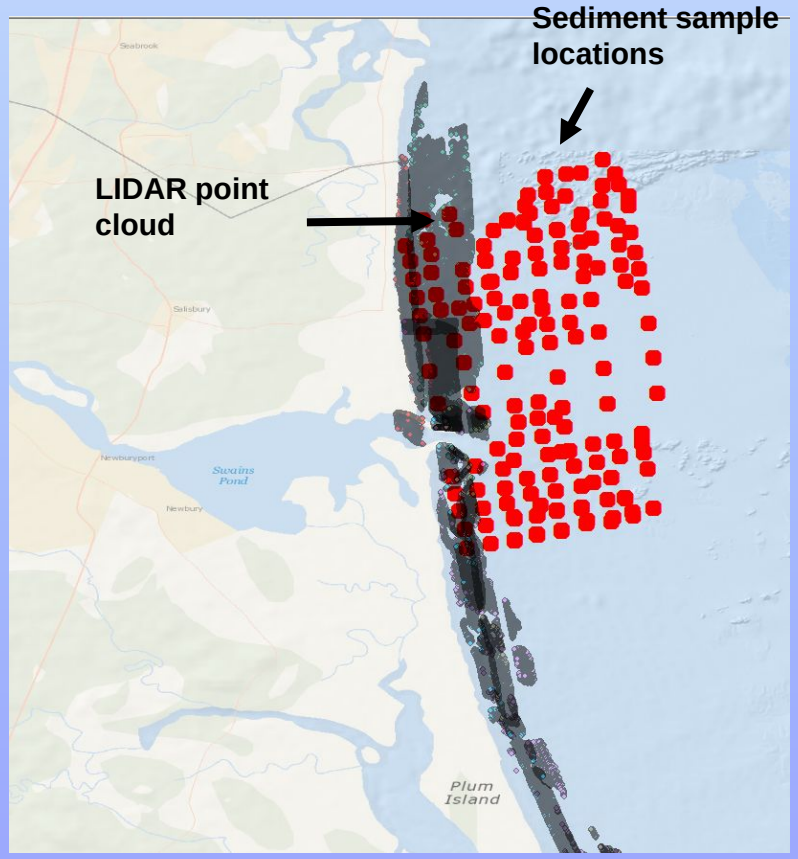






JALBTCX 2011, (Pe'eri et al.)

Survey area



- Merrimack River Embayment.
  NH-MA border
- Data collected with Optech SHOALS-1000 system
- Ground truth
  - 25 sediment stations for grab sampling
  - Underwater imagery
  - Acoustic backscatter

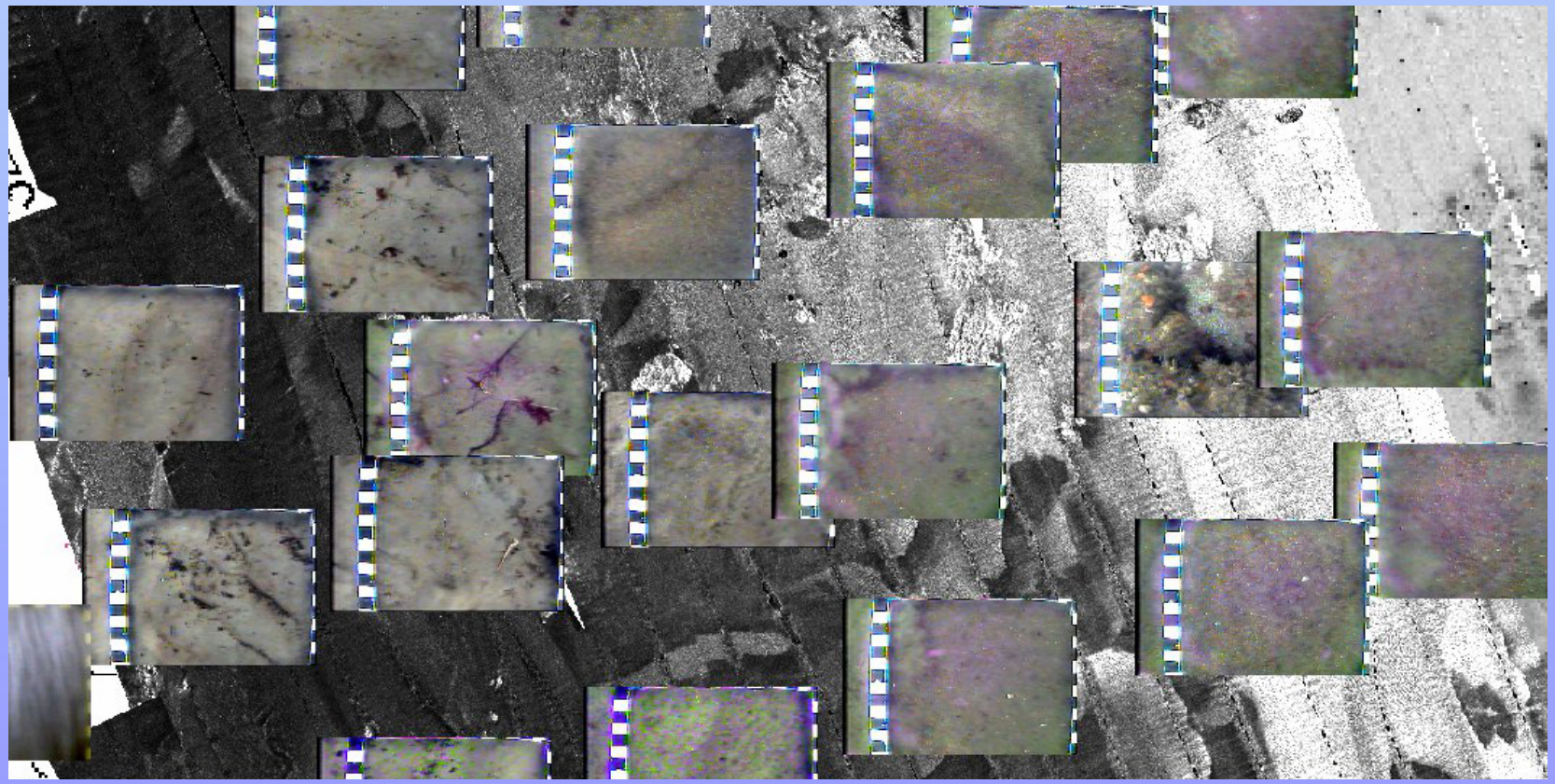
S. Ackerman, Pe'eri, S., Bernhardt, W., Andrews, B., and Gardner, J. V., "Fine-scale sediment distribution at the mouth of the Merrimack River", Coastal Geotools 2011. Myrtle Beach, SC, USA, 2011

S. Pe'eri, Ackerman, S., Guilford, J., Gardner, J. V., and Morris, A., "Ground truth operation for seafloor characterization", Coastal Geotools 2011. Myrtle Beach, SC, USA, 2011

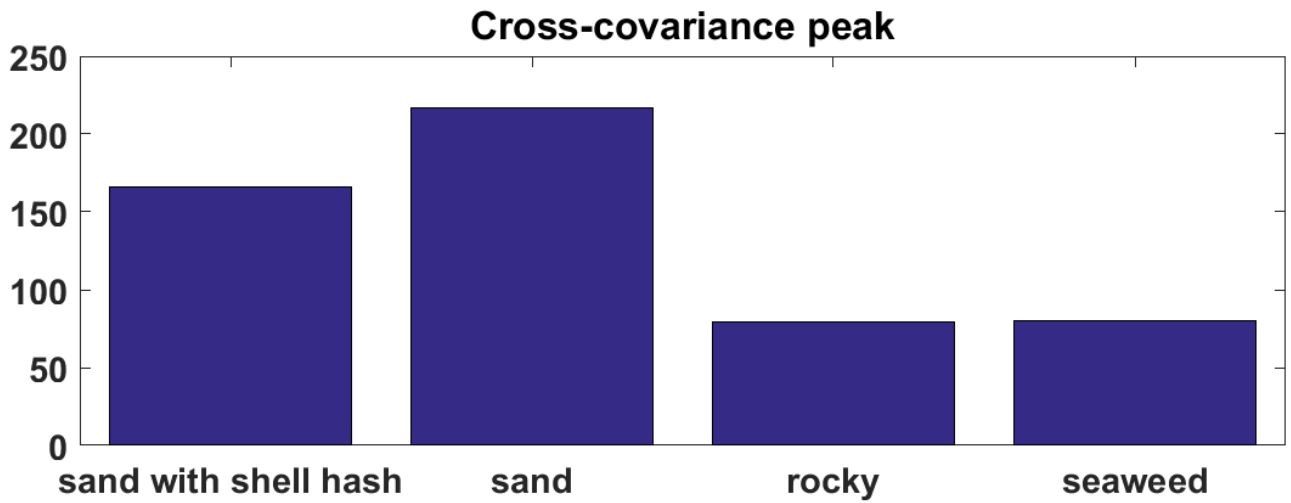
Texture

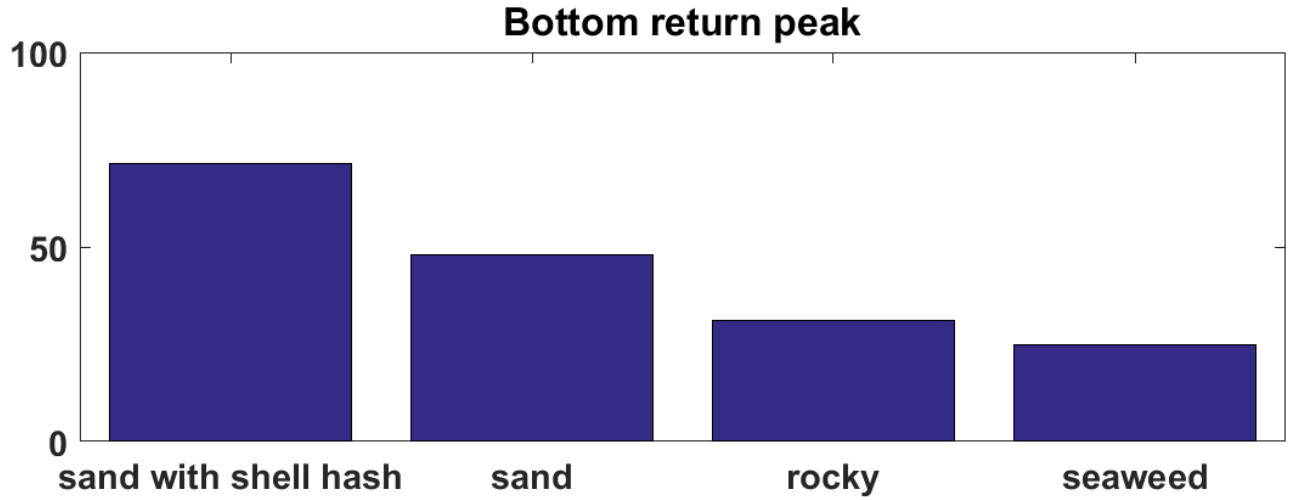
Sediment types

- Sand
- Sand with shell hash
- Gravel and cobble
- Seaweed



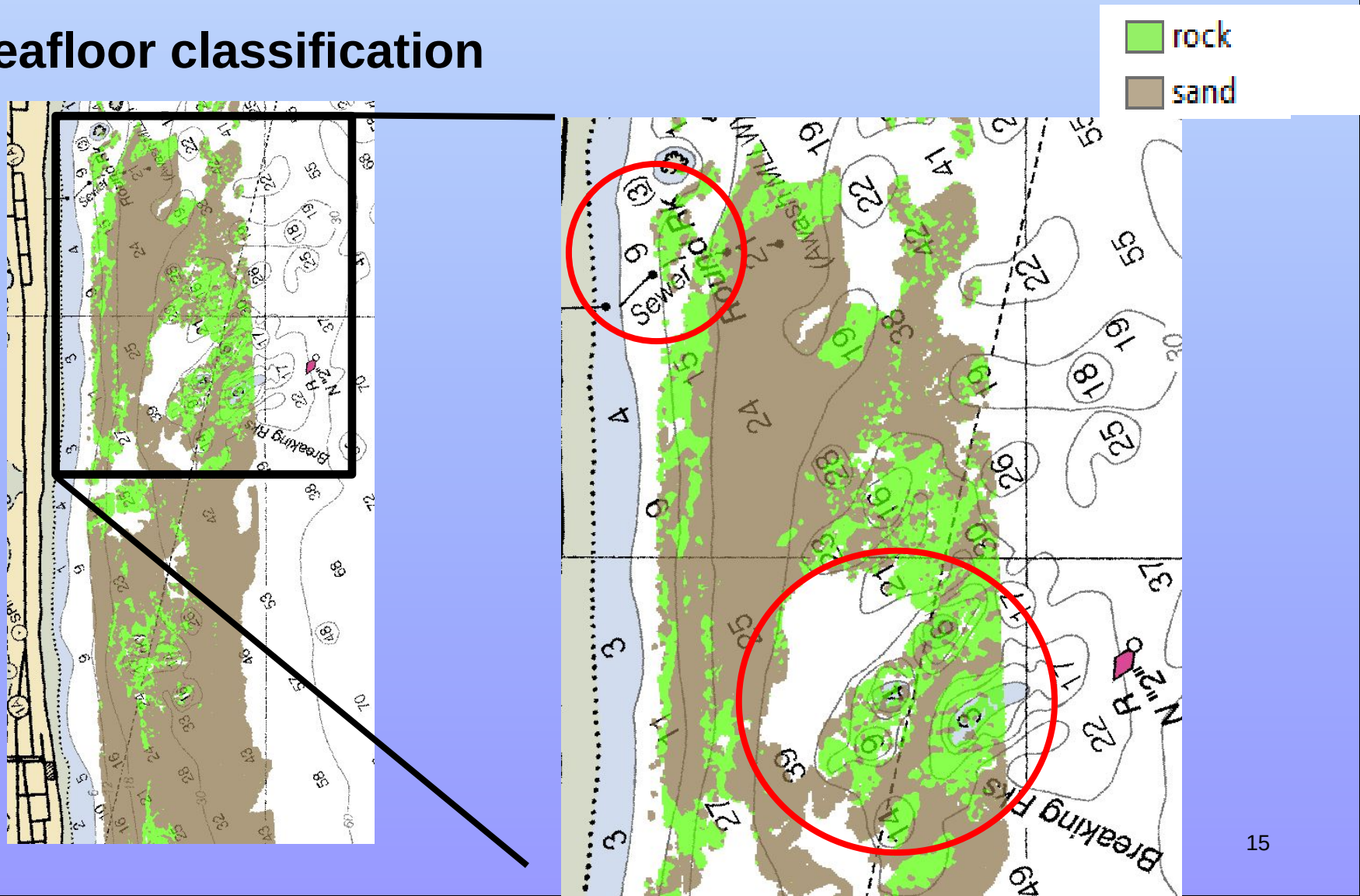
Training data results





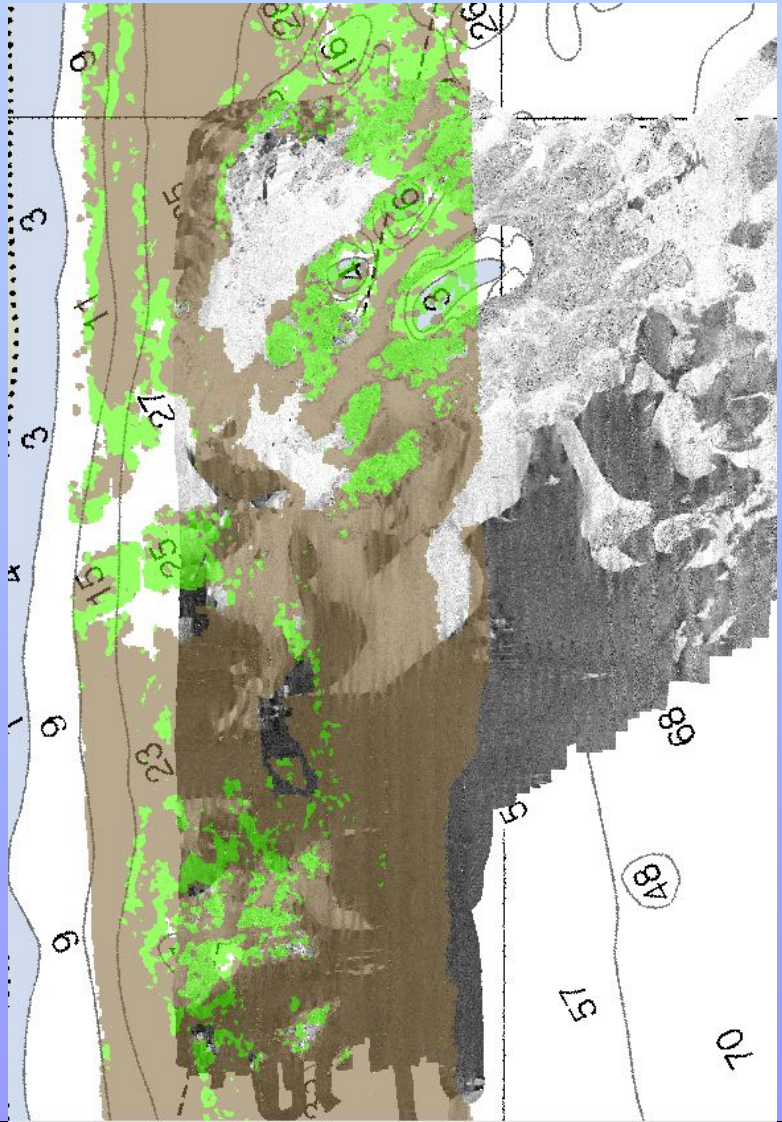
ALB derived seafloor map

Seafloor classification



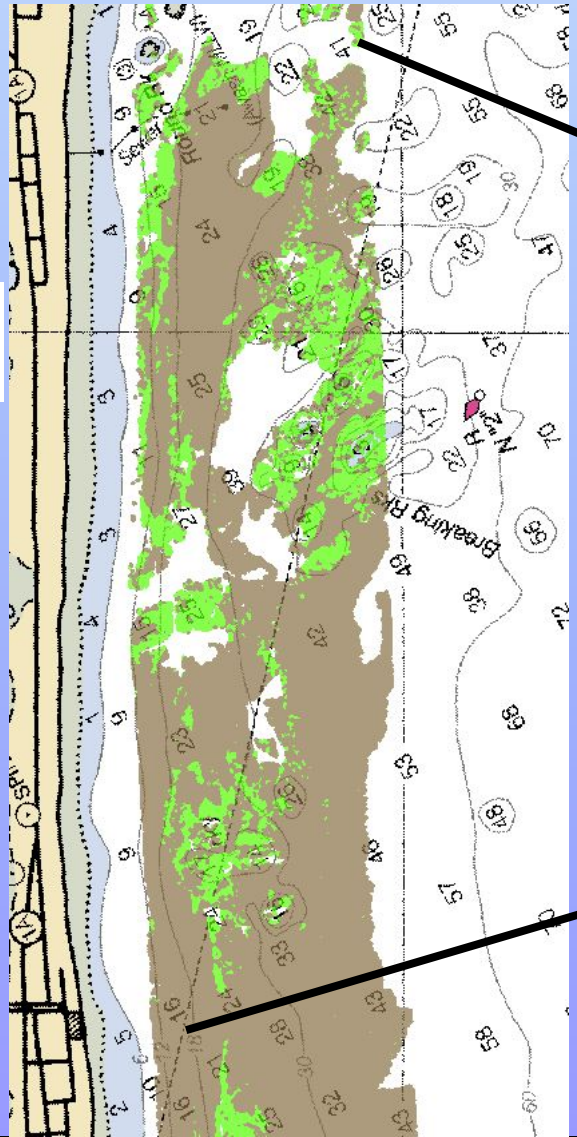
ALB vs. acoustic backscatter

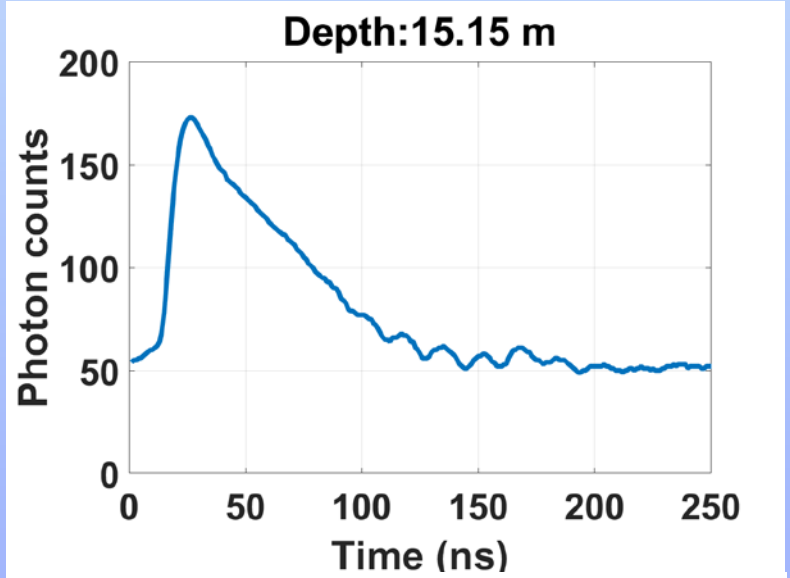
rock
sand

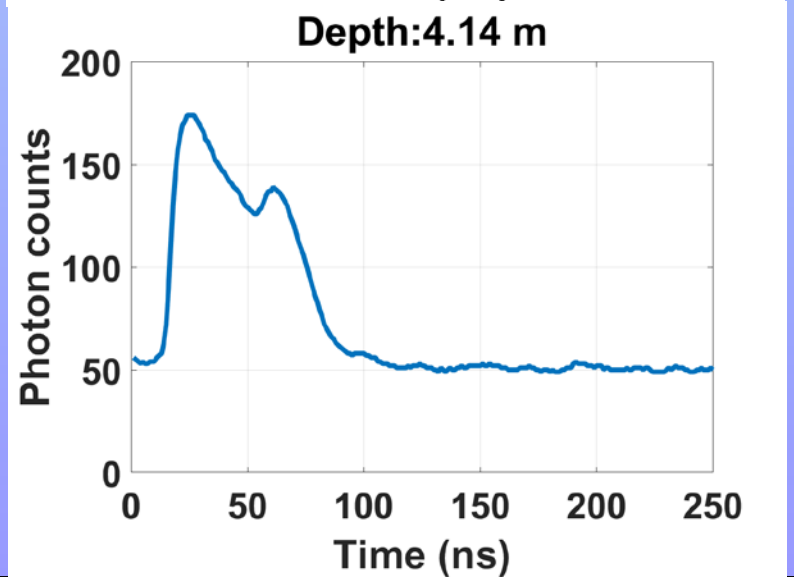


Waveforms in deep water

rock
sand

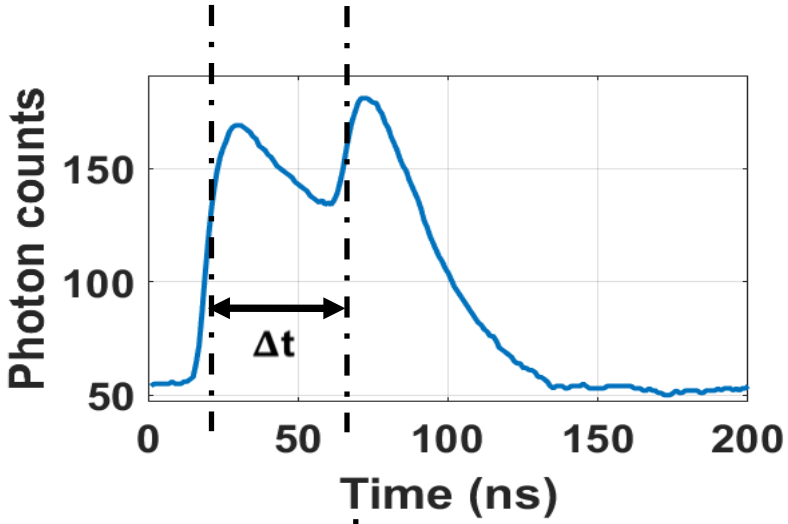


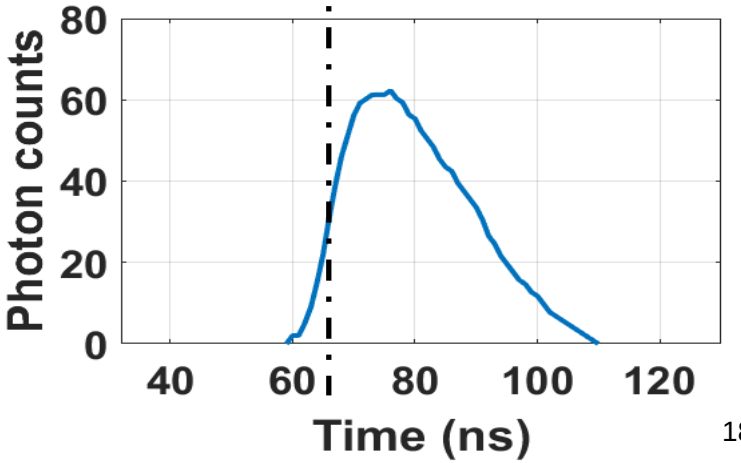




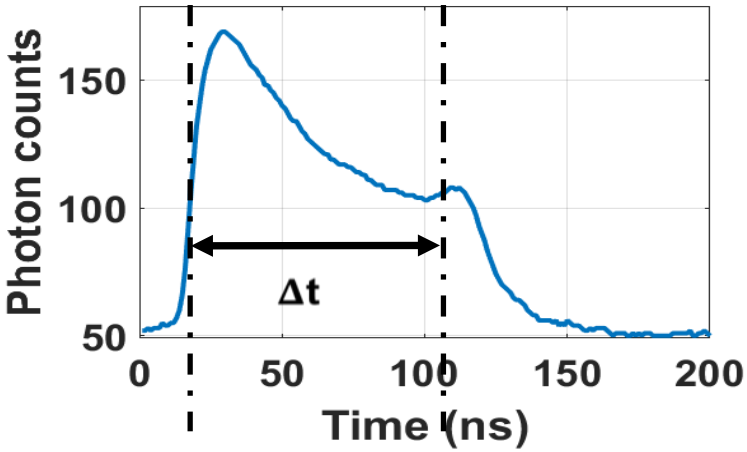
Calculating water depth

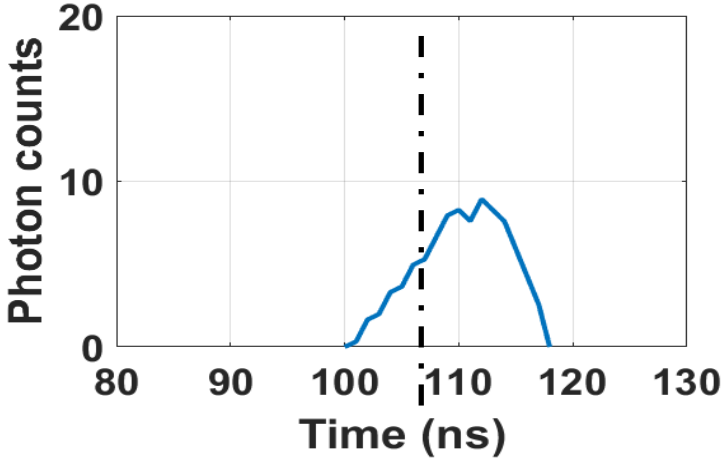
SANDY





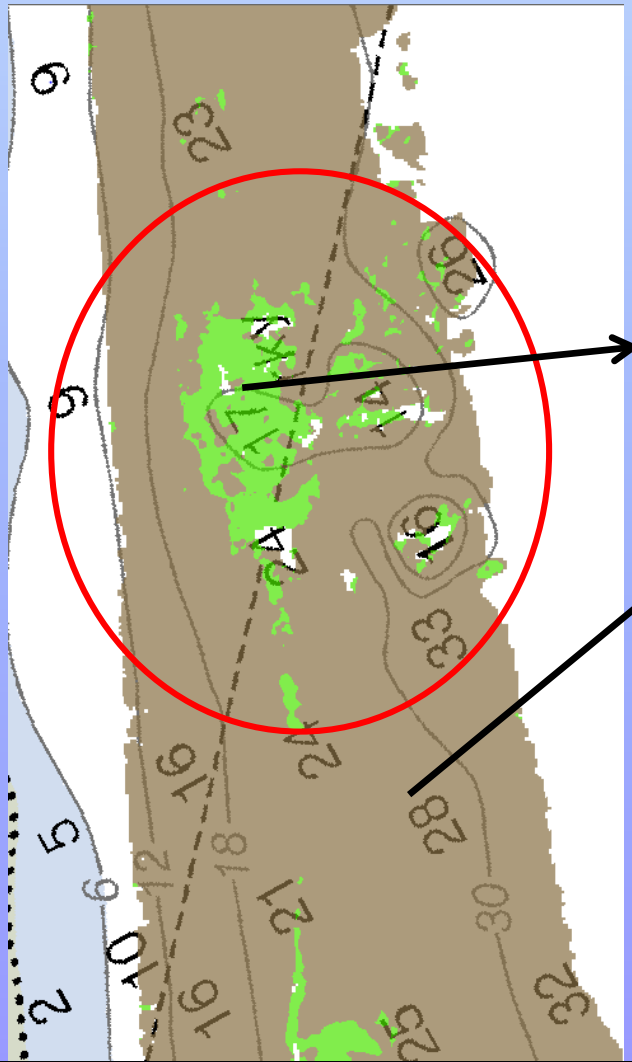
ROCKY





Relationship between seafloor characterization and bathymetry?

Seafloor characterization

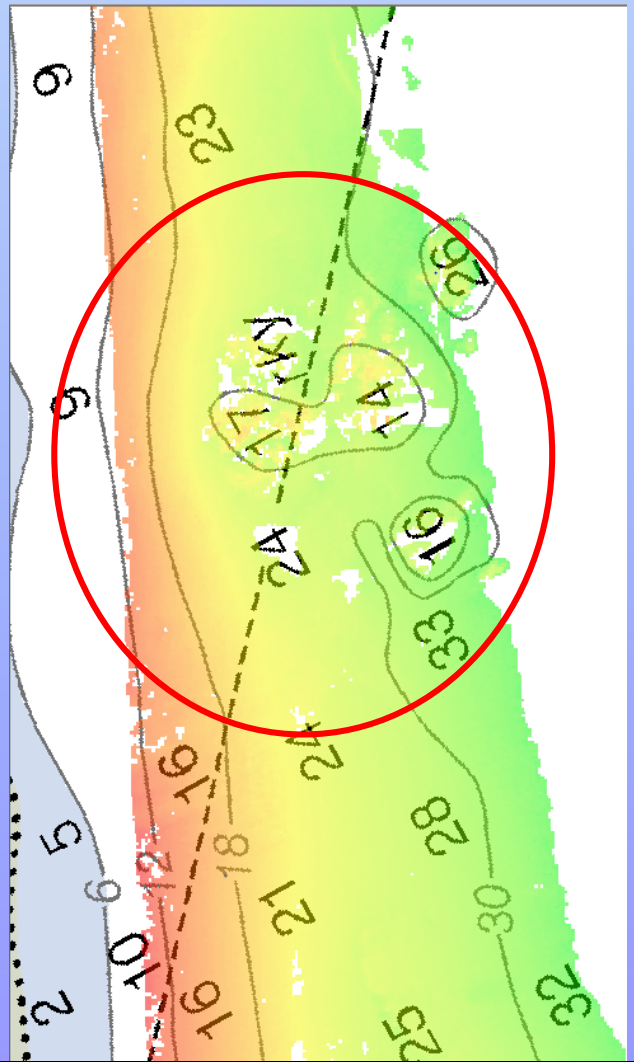


σ_z (rocky) > σ_z (sandy)

rock

sand

Bathymetry



Summary

- Discriminate between critical features: sand and rock, e.g. anchoring.

- Cross-platform approach

- Is there a relationship between seafloor characterization and bathymetric uncertainties?

QUESTIONS??