Mechanical Harvesting of Bamboo

Dr. Daniel Hofstetter and
Dr. Henry Medeiros

University of Florida
Agricultural and Biological
Engineering Department

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Opportunities and Challenges

- Bamboo is a globally important forest product
- Dendrocalamus Asper grows well in Central and Southern Florida

Main Challenges:

- No suitable commercial harvesting equipment
- Manual harvesting is labor intensive

Image source: Guaduabamboo.com (Accessed May 28, 2025)

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Dendrocalamus Asper Bamboo

Conventional harvesting head

Eucalyptus harvesting head

https://www.logmax.com

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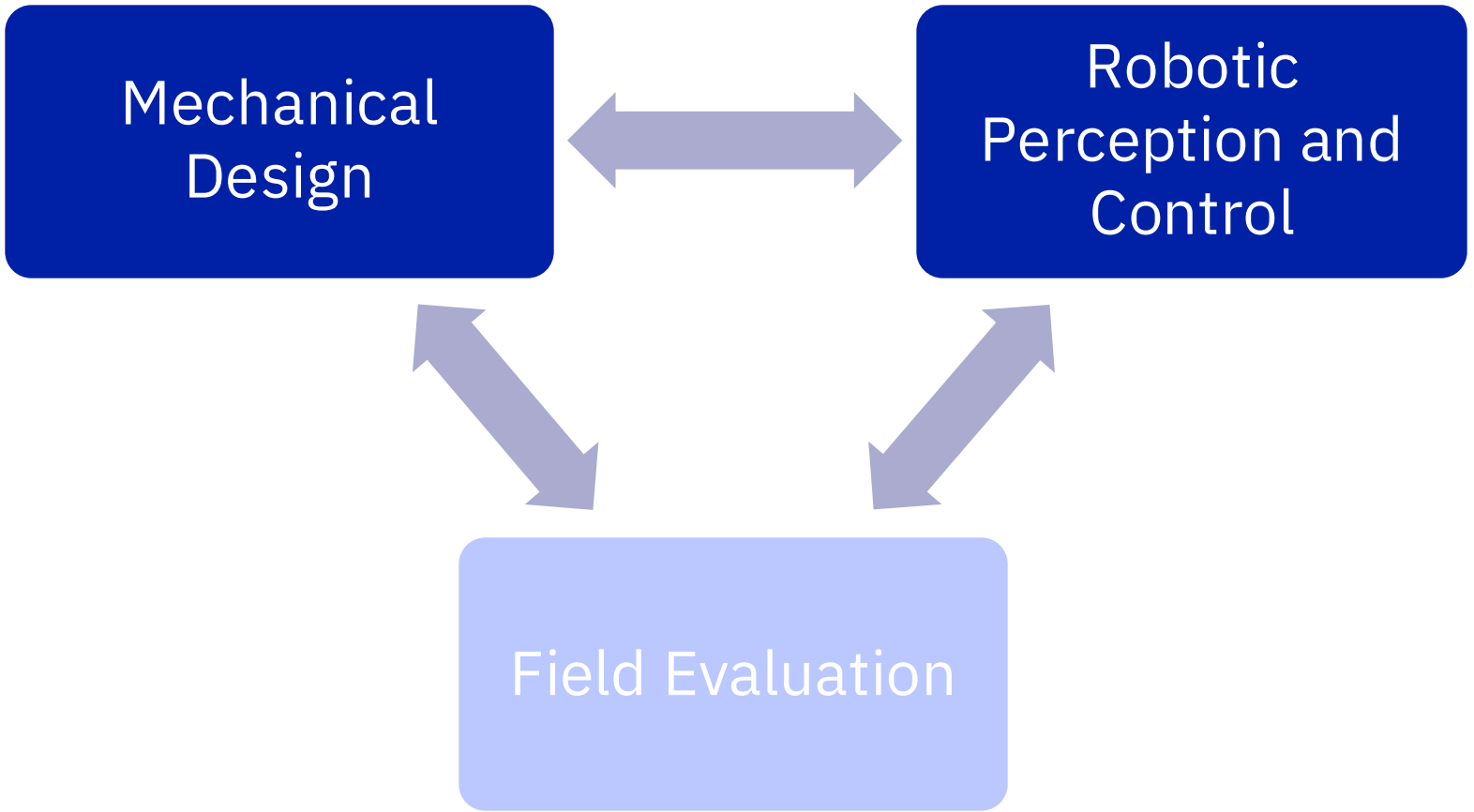
Today's Presentation



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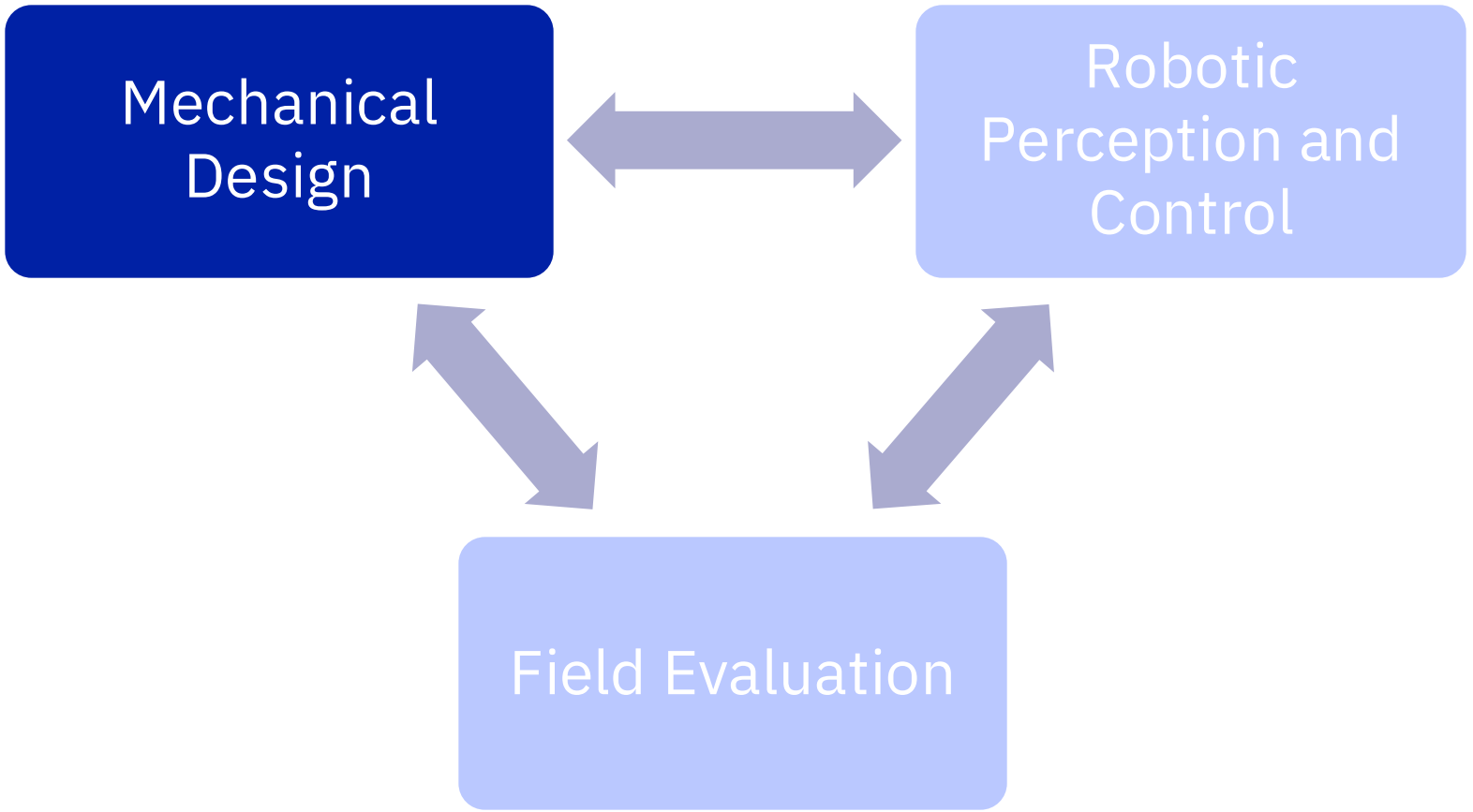
Mechanical Properties Testing



Field Visits

- Visited Year 7, 8, 9 farms
- Test cutting methods
  - Sawzall
  - Lopper Chainsaw
- Collect bamboo samples

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Measuring, Weighing, and Cutting Samples

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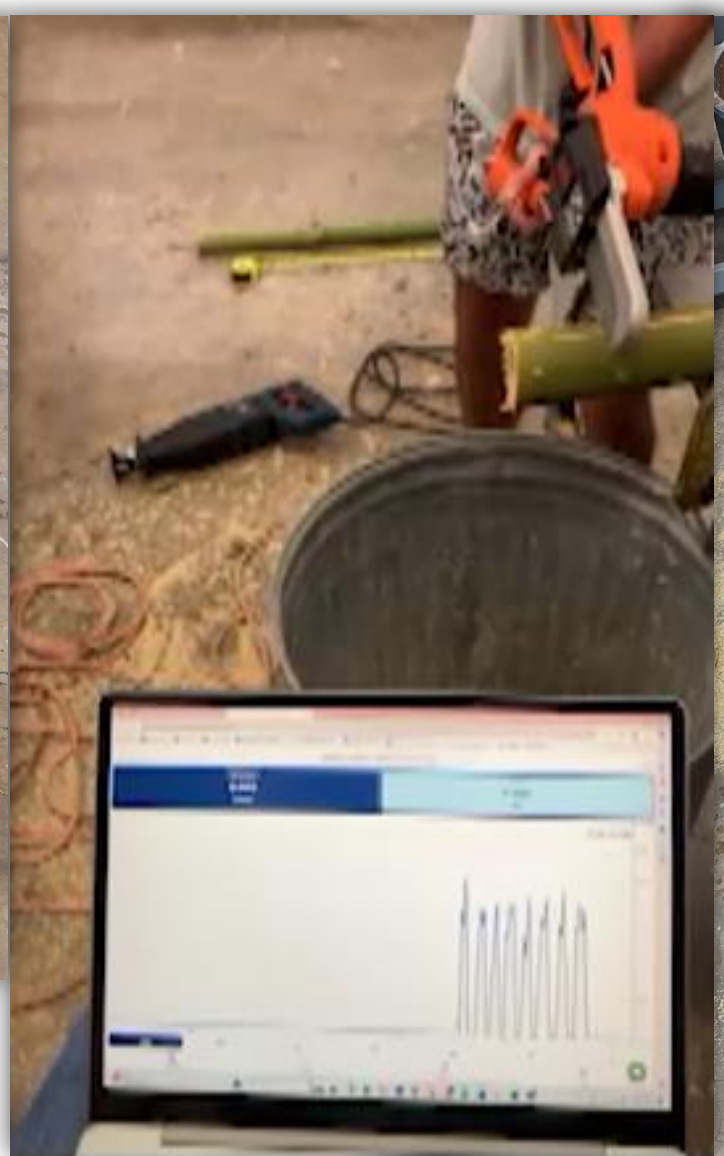
Measuring Power Consumption During Cutting



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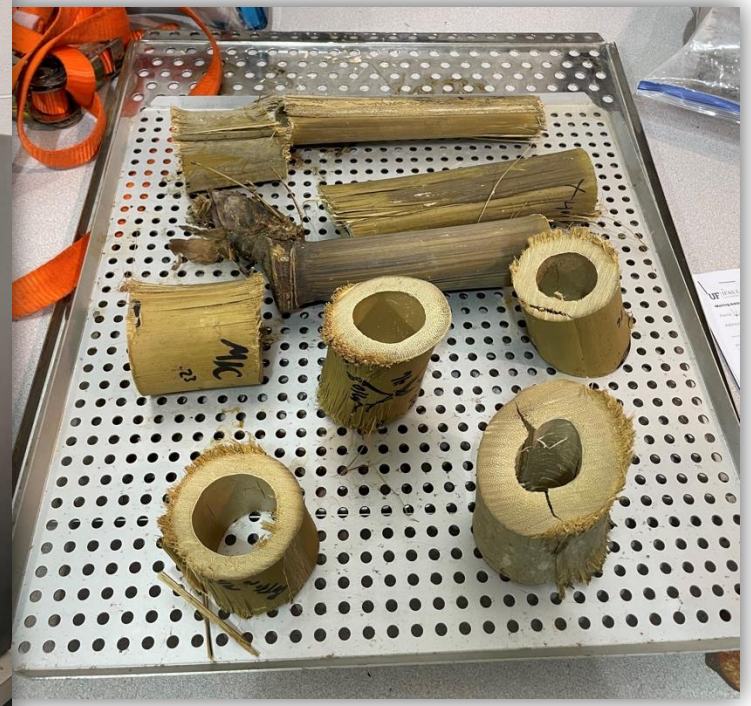
Determining Moisture Content



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Identifying Mature Culms

- Culm appearance changes with age
- Texture, color, sheath leaves
- Sounds different when tapped

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Clump Density

Cutting the Selected Culm

- Type of blade, minimize splintering
- Speed of cut, blade type, durability

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Removing the Culm

- Branches can become tangled

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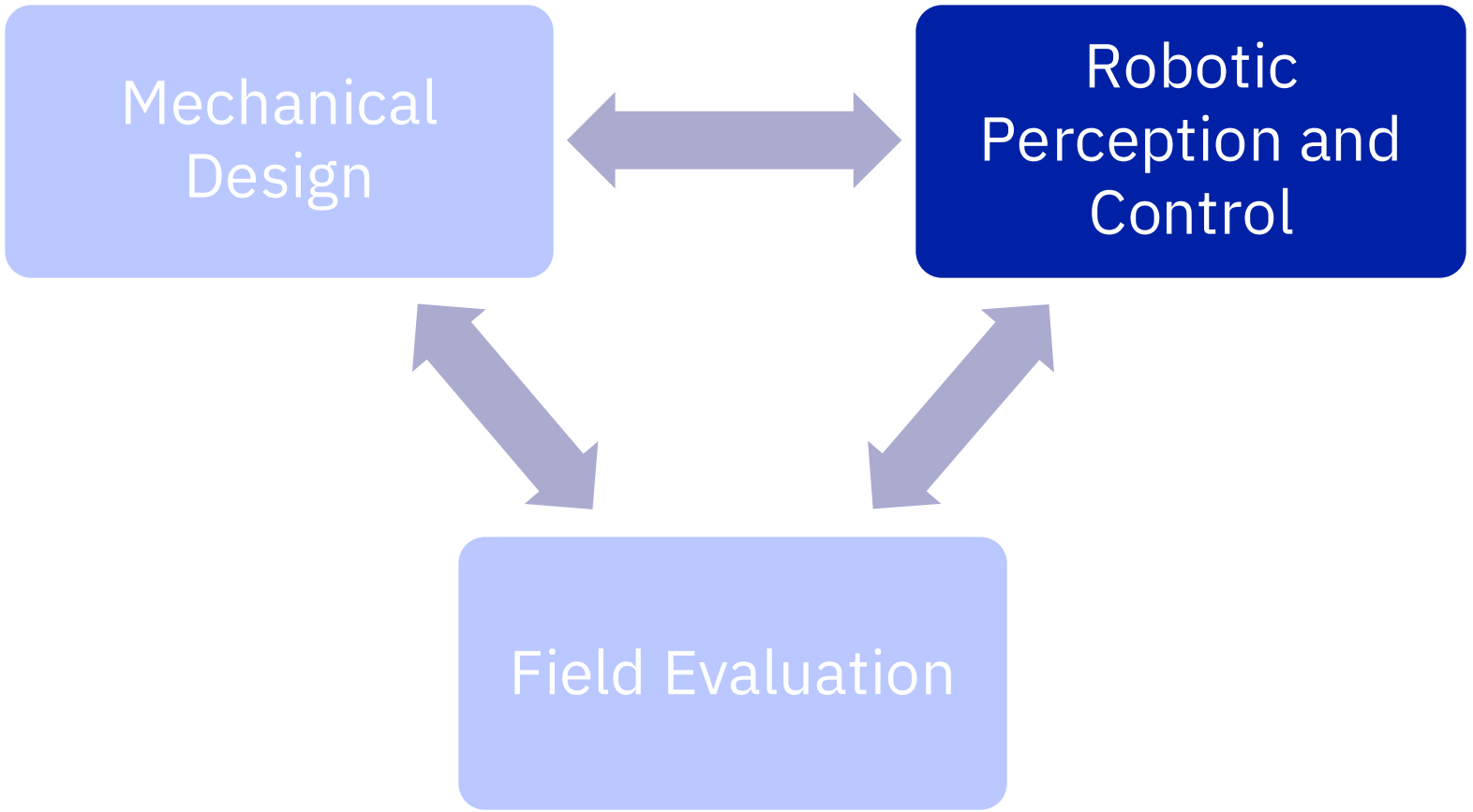
Computer Vision



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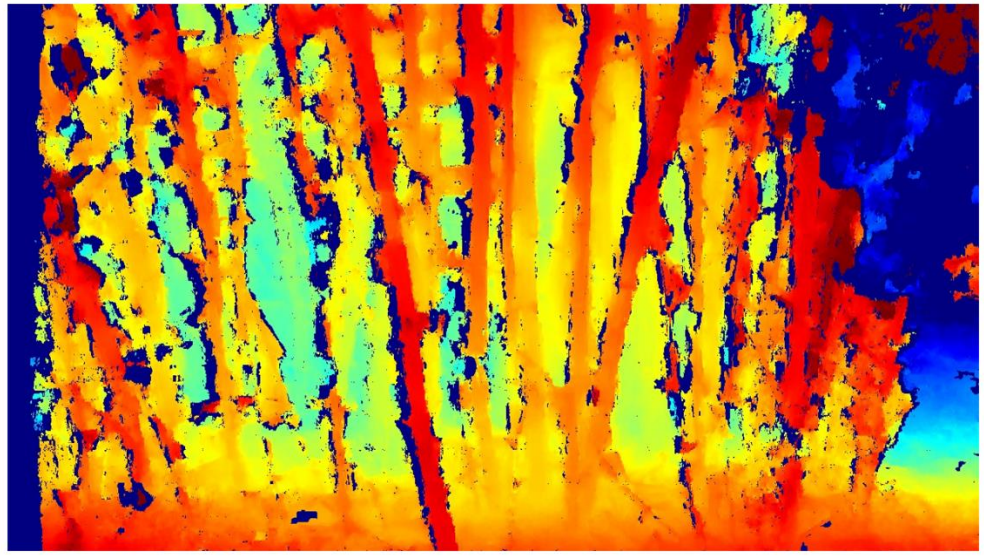
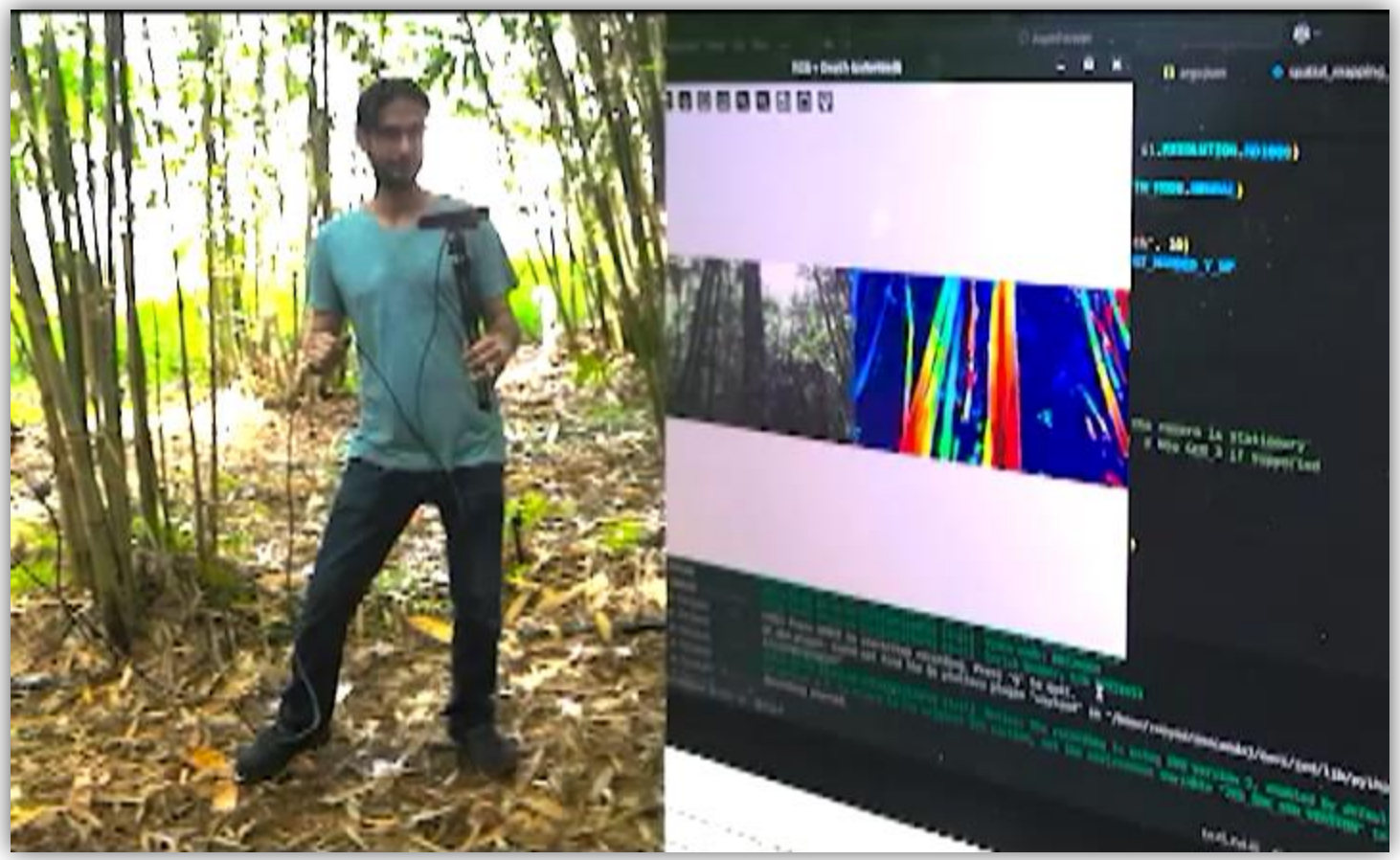
Scanning a Clump

- First step to detect clumps and individual culms

Depth Colormap





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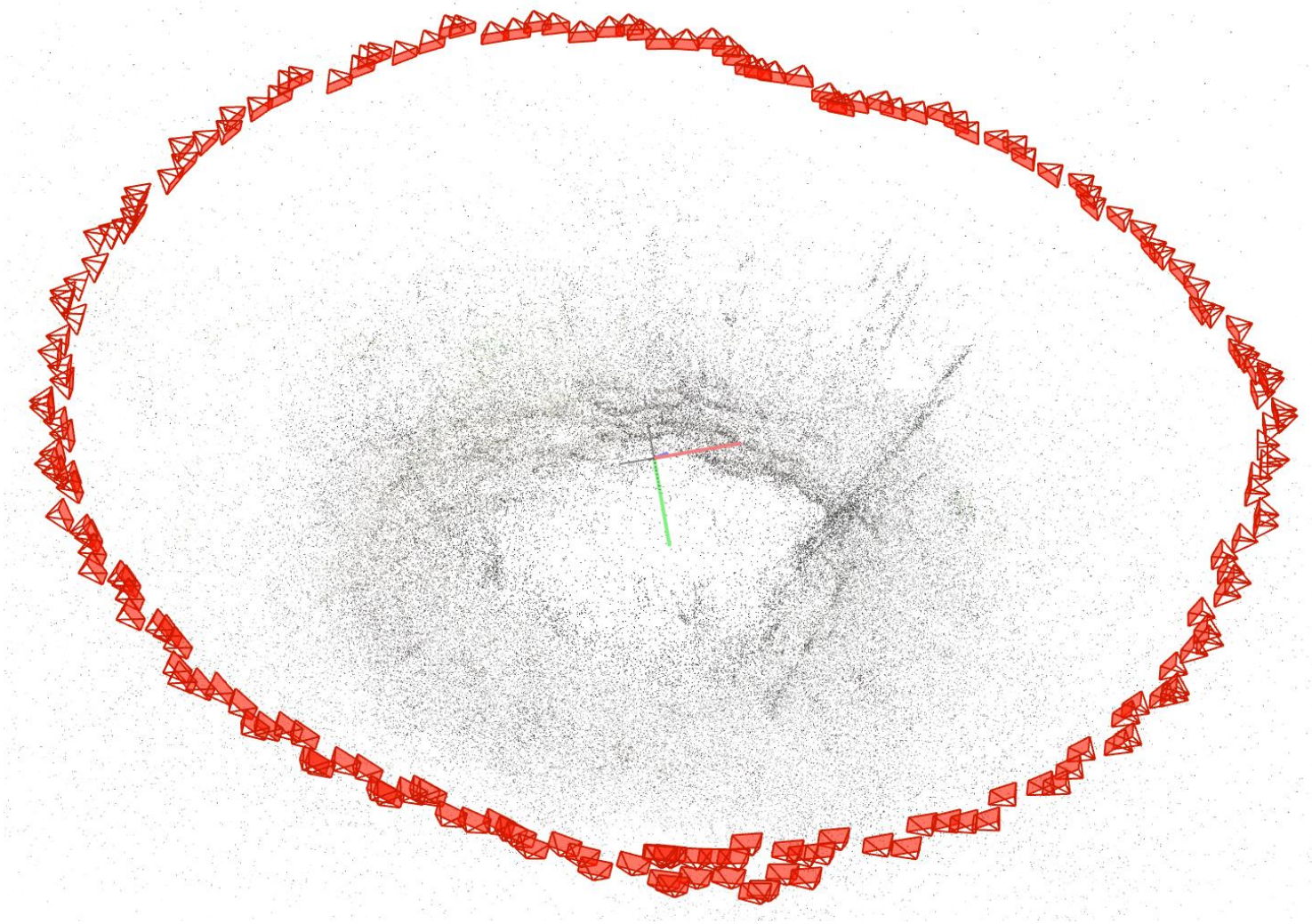
Using 3D Cameras to Detect Bamboo

- Red pyramids represent camera position and view direction
- Grey dots are points on detected surfaces



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3D Reconstruction

- Captures full 3D shape of bamboo culms (height, diameter, position)
- Helps distinguish overlapping culms by their distance from the sensor

Clump physical model

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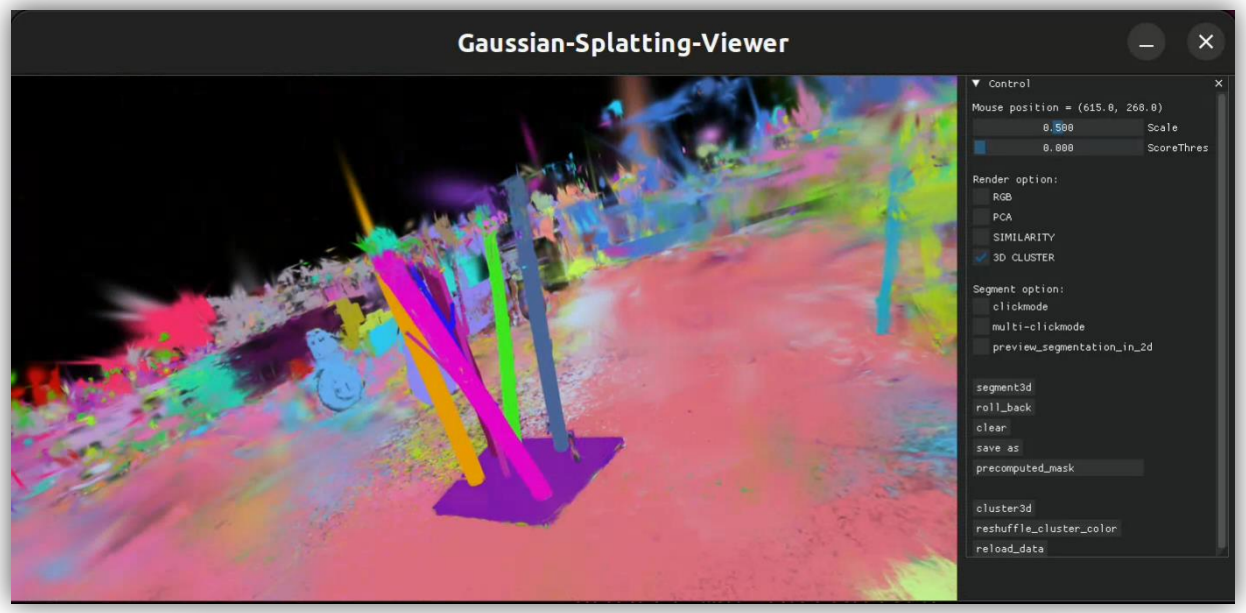
Culm Segmentation

- Vertical cylinders (culms) are modeled and separated based on geometry
- This will allow a user to select mature culms to harvest
- Computer model will plan approach path and automatically manipulate the harvester arm, gripper, and cutter



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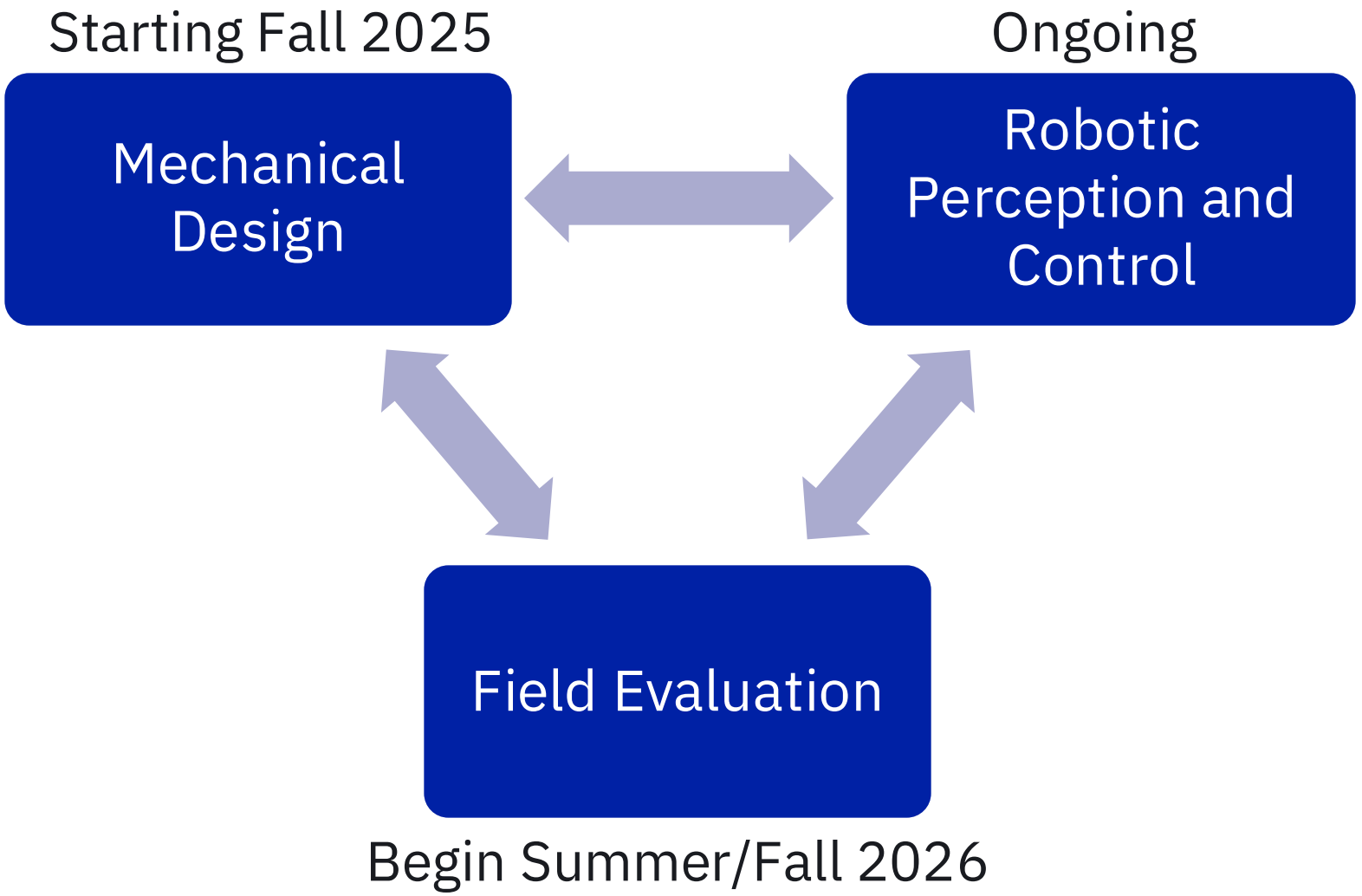
Ongoing Efforts and Timeline



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Questions or discussion?

THANK YOU!

Email: d.hofstetter@ufl.edu

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