#### WELCOME

RIGAKU WEBINAR SERIES X-RAY COMPUTED TOMOGRAPHY FOR MATERIALS & LIFE SCIENCE *PLANT SCIENCE APPLICATIONS* IS STARTING NOW.





#### **Presenter: Angela Criswell**

Senior Scientist Rigaku Americas Corporation



#### Host: Tom McNulty

Senior Vice President Rigaku Americas Corporation





You can send us questions during the presentation. They will be addressed at the end of the presentation.





#### A recording of this webinar will be available. You will receive an email with a link to it tomorrow.



#### X-RAY COMPUTED TOMOGRAPHY FOR MATERIALS AND LIFE SCIENCE Plant Science Applications

**Q** Rigaku

2-2









# You will learn: Sample movement and size Instrument optimization Plant applications

10000



# SAMPLE MOVEMENT

- Shorten data collection time
- Secure the sample
- Hydrate the sample





#### SHORTEN DATA COLLECTION TIME





#### 57 min





#### SHORTEN DATA COLLECTION TIME





57 min

4 min



#### TEST FOR SAMPLE MOVEMENT

- Collect single procession images at one minute increments.
- Subtract image 2, 3, etc from the first image.
  - Movement you should see artifacts
  - No movement blank images





#### SECURE THE SAMPLE









parafilm

UV resin



#### SECURE THE SAMPLE











#### HYDRATE THE SAMPLE



Eppendorf tube



Whole plant imaging



# SAMPLE SIZE

- Instrument optimization
  - Which instrument?
  - What data collection settings?
- Image stitching





• Trees





- Trees
- Full-sized plants
- Root systems





- Trees
- Full-sized plants
- Root systems
- Fruit





- Trees
- Full-sized plants
- Root systems
- Fruit
- Seeds





#### **INSTRUMENT OPTIMIZATION**

• Which instrument is most suitable for my experiment?



Cone beam geometry



Parallel beam geometry



# INSTRUMENT OPTIMIZATION

- Which instrument is most suitable for my experiment?
  - Will the sample fit or do I need a cutting?
  - How will I mount the sample?





# INSTRUMENT OPTIMIZATION

- Which instrument is most suitable for my experiment?
  - Will the sample fit or do I need a cutting?
  - How will I mount the sample?
- What features do I want to see?
  - Voxel size?







# IMAGE STITCHING

- Large samples may require multiple data collection scans.
- Collect 'overlapping' sections of the sample for ease in image stitching later







# IMAGE STITCHING

- Large samples may require multiple data collection scans.
- Collect 'overlapping' sections of the sample for ease in image stitching later









#### LET'S LOOK AT SOME EXAMPLES



# IMAGING FULL SIZED PLANTS

• Tomato plant imaging







# ROOT SYSTEMS

• Tomato plant imaging



Choice of growth media can make the difference in your ability to segment for analysis later





- Imaging corn
  - Scan several sections
  - Allow for some overlap











- Imaging corn
  - Scan several sections
  - Allow for some overlap







#### • Quantifying Z position of kernels







#### • Quantifying kernel volume









#### HOW ABOUT SEEDS?



#### Mung and millet seeds

Sea bean









Millet seeds











#### MILLET SEED



#### Seed hull volume - 1.5%







https://commons.wikimedia.org/wiki/File:Entada\_rheedii04.jpg



https://en.wikipedia.org/wiki/Entada\_rheedii









#### **CRANBERRY SEED**







## CRANBERRY SEED

- Seed hull
  - 3.3%
- Void volume
  - 9.9%





#### LEAF









LEAF















LEAF







#### ALL IMAGES WERE COLLECTED ON...



#### nano3DX CT Lab HX CT Lab GX







#### To learn more ...



# Rigaku.com → Contact





#### PREVIOUS WEBINARS

# www.rigaku.com/en/webinars/ x-ray\_ct\_introduction









Next on X-ray computed tomography Geology Applications

# July 15<sup>th</sup> Wednesday 11:00 am PDT / 2:00 pm EDT



# Q & A SESSION





#### **Angela Criswell**

#### **Tom McNulty**











We'll follow up with your questions.

Recording will be available tomorrow.

Register for the 6th webinar.



# THANK YOU FOR JOINING US SEE YOU NEXT TIME!

