CT Basics—Micro CT

What kind of sample can be scanned in the micro-CT?

Samples can be smaller than 1 mm^3 up to about 100cm long and 8cm in diameter. We have scanned plant, insect, and vertebrate animal specimens, live animals, engineered materials, archaeological artifacts, fossils, and stone.

An ideal sample, which will give the highest quality image with the shortest scan time, is:

-Stable and unmoving for the duration of the scan.

-Contains no dense materials in the path of the scan (metal tags, pins, glass containers, etc)

What do I need to consider for imaging live animals?

Live animals need to:

-Be stable and unmoving for the duration of the scan (5-30 minutes). We have an isoflurane anesthesia setup that can go into the CT scanner. Some slight movement due to breathing are ok for most scans.

-Fit into the x-ray tube, a diameter of ~8cm. Animals under 1kg will generally fit.

Please note that metal housings, ear tags, iron-based hand warmers, etc. should be out of the x-ray path when possible, as their presence will cause significant artifacts in the final data. Cardboard, plastics, paper, gauze, gel, and tape are fine.

What resolution can I get? How large a volume can be scanned?

The GE CT-120 detector is a fixed distance from the source. The maximum resolution is 25 microns/px, but the detector can be binned to 50, 100, or 200um/pixel for lower resolution, smaller file size, and lower noise. The field of view of a single scan is about 8cm in diameter and 5cm long. The full data set can be extracted at about 100 microns/px; for higher resolution scans the volume will need to be trimmed.

Do I need to stain my sample?

It depends on the structures you want to see. Researchers looking at soft tissue structures or plant cells are generally more satisfied with their results after CT staining. Contact BRC Imaging staff for assistance.

How should I prepare my sample?

For most samples, we can scan them as-is, or with minimal preparation.

-Ceramic or polymer materials: Can generally be imaged as-is.

-Plant specimens: samples can be stored in fluid in centrifuge tubes, mounted in paraffin blocks, or imaged as-is. Removing the specimen from the plant is usually preferable but not always necessary.

-Small animal specimens/organs (less than ~1-2 cm^3): We can usually scan these as-is. Imaging through plastic is better than glass; a 15- or 50- mL conical tube or plastic bag is a suitable container. Since a floating sample may move during imaging, we may constrain the sample with a piece of foam prior to scanning. Less extraneous fluid typically results in better quality data; we will usually remove most or all of the fluid in a container prior to scanning but will discuss this with you beforehand.

-Larger animal specimens preserved in alcohol: We will typically remove the animal from its container and place it in a sealed leakproof bag prior to imaging.

-Live animals: Discuss any experimental needs (restraint, anesthesia, etc) with BRC staff beforehand.

-Fossils, bones, shell, etc: Can generally be imaged as-is.

How long will a scan take?

This depends on the material, the contrast needed, and the resolution required. Most scans on the CT-120 take less than an hour.

What is the turnaround time for my sample?

For a small number of samples, we can typically return data in under a week. The turnaround time for larger sets of samples depends on how these scans fit in with the current queue. If we can schedule scans in advance it's usually easier to guarantee a particular timeline. Contact CT staff for time estimates.

How can I look at my data? What format is it in?

You will receive data in either a DICOM or .vff format, where each image is a single slice from the reconstructed CT data. If you want a video or 3D analysis to be performed, please discuss this with the staff beforehand for a price estimate.

For researchers on campus, we can give you access to Avizo, Microview, and Osirix, 3D image processing programs. Users who wish to do data analysis from outside Cornell will need to purchase appropriate imaging and analysis software.

Can you do a test run of my sample?

Yes! We're happy to work with you to figure out if CT is appropriate for your samples.

For preliminary proof-of-principle scans (<1 hr), we will scan your specimen free of charge.

Can I run samples myself?

Only under exceptional circumstances. Please contact BRC staff if you think your experiments will require this.

What are the steps I need to take to have my sample scanned at the BRC Imaging Facility?

1) Plan your experiment, read this document, and contact the BRC Imaging staff with any preliminary questions, quote requests, etc.
2) Create a BRC account at https://cores.lifesciences.cornell.edu/userdev/index.php . Include your Cornell Account number or send in a PO. Scans will not be performed until a payment method is in place.
3) Ship your samples or bring them to B46 Weill Hall. Samples brought in person can be left in the black cabinet on the "IN" shelf.
4) Data will be sent via Cornell Box as it is taken, with a final confirmation email sent once the work has been complete. Work is typically billed at the end of any month that work has been performed.