APPN
Australian Plant Phenomics Network

Multispectral 3D scanning

APPN provides multispectral 3D scanning services that enable researchers to monitor plants non-invasively over time. The scanner output can be used directly for downstream data analysis and visualisation, using statistical programs such as R and point cloud viewers.

plantphenomics.org.au

APPN
Australian Plant Phenomics Network

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Australian National University

Australian Plant Phenomics Network

Multispectral 3D scanning

Multispectral 3D scanning allows researchers to monitor plants and traits of interest non-invasively and repeatedly throughout the course of an experiment.

Capability highlights

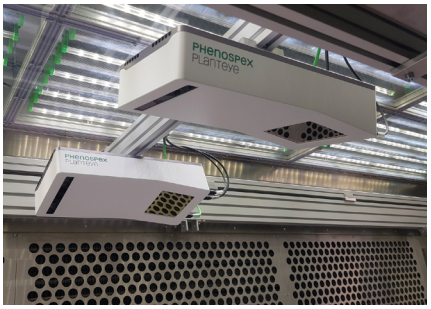
- 3D and multispectral scanning for comprehensive plant trait analysis.
- Multiple scanners available in both Physical Containment level 2 (PC2) and non-PC2 environments.
- Each scanner is a dualscan unit with two sensors at an angle, to resolve complex plant architecture at sub-millimetre resolution.
- 14-20 morphological and spectral plant traits captured per scan.
- Versatile tool, suitable for plants of different sizes and growth stages.
- Direct data outputs for statistical analysis (.csv) and visualisation (.ply point clouds).
- High-throughput phenotyping for efficient, repeatable measurements.

About

The APPN Node at ANU hosts multiple scanners across both PC2-certified and non-PC2 facilities. Two scanners are located in the glasshouse and controlled environment spaces (PC2), while a third operates within climate-controlled growth capsules (non-PC2).

These systems enable rapid, non-invasive capture of diverse plant traits, including:

- Plant height
- Biomass
- Light penetration depth
- 3D leaf area and projected leaf area
- Leaf angle
- Normalised difference vegetation index (NDVI)
- Normalised Pigment Chlorophyll ratio index (NPCI)
- Plant Senescence Reflectance Index (PSRI)
- Green Leaf Index (GLI) and more.



A specialist operator from the APPN team is needed to program the scanner, offer advice for the best outcomes, review data quality and troubleshoot if necessary.

At the start of each experiment, an APPN staff member will consult with the researchers to tailor the scanning process to their needs. Our staff also assist with plant handling to ensure high-quality data collection, and can support plant propagation if required—particularly helpful for users based outside ANU.

Research benefits

Traditional manual phenotyping methods are often labour intensive and potentially destructive, limiting the frequency and scope of measurements. In contrast, multispectral 3D scanning enables efficient, non-invasive data collection, allowing researchers to monitor plants repeatedly over time and compare results throughout their life cycle.

Non-invasive 3D-scanning can be used for a range of applications, for example:

- Investigating growth effects of bio stimulants.
- Studying effects of heat on crops such as wheat.
- Comparing growth rates across genotypes.
- Studying effects of soil microbes on plant growth.
- Assessing drought responses in plants.
- Monitoring effects of elevated CO_2 on plant phenotype.

Expertise at ANU

Our team has successfully scanned a variety of plant species using 3D multispectral scanners, including crops (such as wheat, barley, and canola), model plant species (*Setaria*), *Pinus radiata* seedlings, tulips, and several native plant species.

Access

Access to infrastructure on the ANU campus is restricted to ANU staff and students. For external clients, we can organise 3D scanning experiments as a fee-for-service and/or help arrange guest visits during the experiment for training or hands-on instrument demonstrations. Please contact us to learn more.

Technical Details

Technical specifications

- Overhead gantry-mounted dual scanner systems
- Reflectance in Red, Green, Blue and Near-Infrared

Data outputs:

- Numerical values (.csv) and 3D point clouds (.ply)

Capacities:

- Scans plants up to 1.2m tall (including pot height)
- Scan area (Scanner 1): 3.34 x 0.8 m
- Scan area (Scanners 2 and 3): 2.0 x 0.7 m

Locations:

- Scanner 1 – Located in the PC2-certified Plant Growth Facility, alongside 31 reach-in growth cabinets.
- Scanner 2 – Co-located with eight non-PC2 walk-in growth chambers.
- Scanner 3 – Situated in a PC2-certified glasshouse.

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Discover more:
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