

# PLANT PHENOTYPING

With  
QUBIT PLANTSCAN

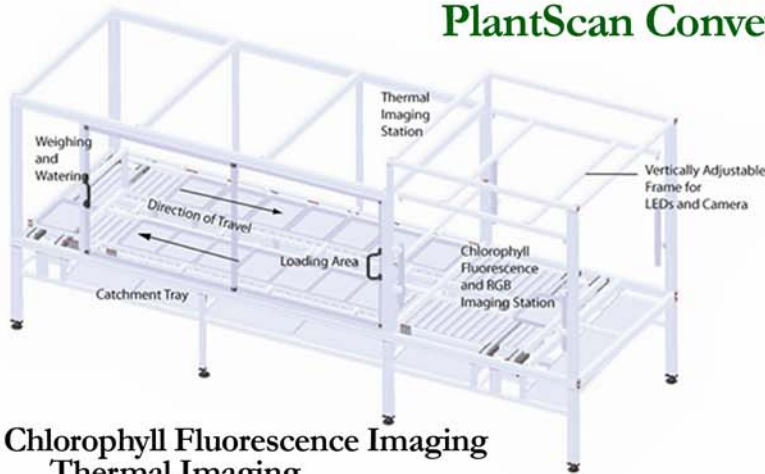
High-Throughput Screening  
Pathogen Interactions  
Environmental Stress  
Trait Assessment  
Genetic Variation



# Conveyor and Robotic PlantScan Systems

From *Arabidopsis* to crop plants, the PlantScan can be optimized for numerous plant morphologies and structures. The conveyor system can be configured for single pots, multiple pots or trays, providing flexibility of use with numerous different species, or with a single species throughout its growth cycle. We ensure that PlantScan systems meet your specific requirements.

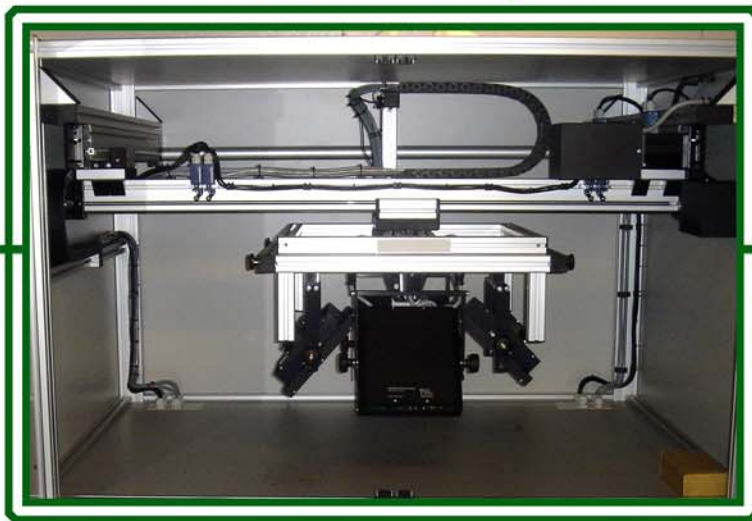
## PlantScan Conveyor System



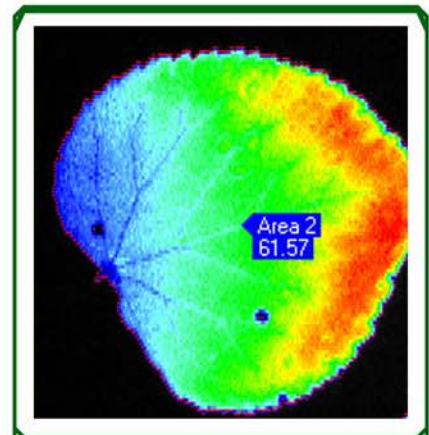
Conveyor systems allow for automated loading and unloading of samples, with tracking of pots and trays by barcode reader or RFID tags. Conveyors may be enclosed by light equilibration chambers for control of actinic light exposure, or dark adaptation, prior to chlorophyll fluorescence imaging. LED panels allow for precise control of irradiance at specific wavelengths, providing low to high light intensities without heat load, and the ability to create complex lighting protocols. Infra Red LEDs provide user-determined heat load within the thermal imaging station.

**Chlorophyll Fluorescence Imaging**  
**Thermal Imaging**  
**RGB Imaging**  
**NIR Imaging**  
**Hyperspectral Analysis**  
**Automated Watering and Weighing**

## PlantScan Cabinet System



In cabinet-based screening systems the imaging apparatus is carried above the plants on a robotic arm. The cabinet is fitted with LED lights to provide actinic irradiance and the saturating pulses required for chlorophyll fluorescence measurements. The robotic arm moves from tray to tray or pot to pot, as well as vertically to optimize distance for imaging plants of different heights. Individual imaging areas can be selected to suit the sample size and configuration, ranging from 13 cm x 13 cm per imaging frame, to 35 x 40 cm per imaging frame. Cabinet sizes can range from small units of 100 cm length, to entire growth rooms. Cabinets and rooms can be fitted with complete climate control (temperature, RH, irradiance protocols), and gas regulation options (pO<sub>2</sub> and pCO<sub>2</sub>)



**Stress Screening**  
**Nitrogen Status**  
**Water Status**  
**Disease Conditions**  
**Pathogen Infection**  
**Ecotoxicology**



# Screening Systems from the FluorCam Family

Z240



The **Z240 Rover FluorCam** is designed for large-scale screening in the field. Large plants (e.g. corn, soybean) can be studied *in situ* without detaching or destroying them. The camera and light panels can be enclosed in a cabinet for dark adaptation and control of actinic light. Scanning area and height can be adjusted. Chlorophyll fluorescence, true-color analysis, thermal imaging and NIR options are available.

The **Z200 Open FluorCam** is a modular instrument with flexible geometry. The LED panels and the light sources can be arranged at various angles and distances from the sample. The position of the camera may also be adjusted. The maximum area for imaging depends on the size of selected light sources.



The **Z230 Arch FluorCam** is a customized imaging system for three dimensional studies. With its rotating platform and robotic arch, the structure provides flexible viewing angles so that large plants can be analyzed from various positions without the need to move them. Data are collected for software generation of 3-D images of Chl-fluorescence and other imaging parameters.



Z230

## ALSO AVAILABLE:

- **Handy FluorCam** - field studies (3 x 3 cm imaging area)
- **Transect FluorCam** - field studies; scans across linear transect.
- **Micro-FluorCam** - microscopic imaging (cells and organelles.)

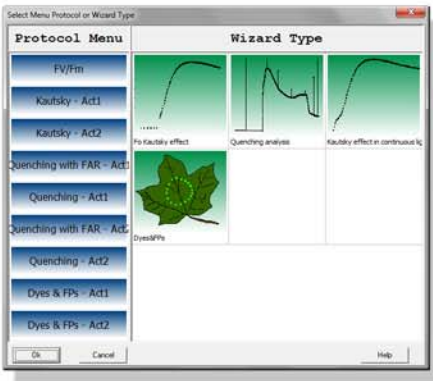
Custom-designed systems can be configured to user's specific requirements. All FluorCam systems include a high-performance PC and comprehensive software package.

The **Z100 Closed FluorCam** is a highly innovative multispectral kinetic fluorescence imaging system. The imaging area is 13 x 13 cm – suitable for small plants, detached leaves, algal dilutions, tissue culture calluses, seeds etc. The system allows for dark adaptation, and a filter wheel allows measurement of GFP and other fluorescence compounds.

Z100

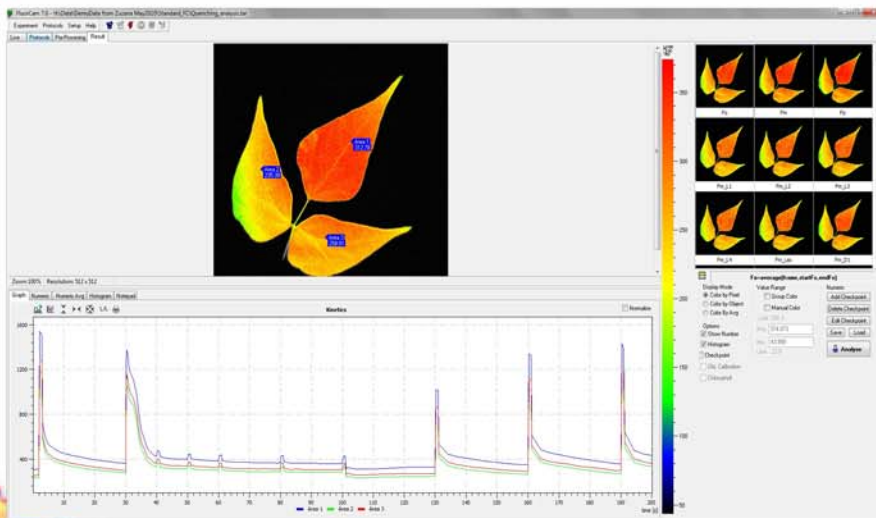


# Software



- Controls all mechanical and imaging aspects of the system, either by PCL based systems for engineering control and PC / Linux based systems for analysis, or with PC control for all systems.
- Includes default protocols for all measurements, with development kit to allow the user to create customized protocols.
- Automatically controls movement of pots or trays through the system for each imaging station, activates cameras and captures image data to an SQL database.
- Allows any one or all of the imaging stations to be utilized depending on the requirement of the experiment.
- RGB digital growth analysis from 3 camera views, including thresholding and color analysis.

- For chlorophyll fluorescence imaging, software allows batch analysis of images for fluorescence quenching parameters including user-identified regions of interest and averaging of pixel values on background subtracted images.
- Analyzed data are stored in the database with co-registration of raw image data and analyzed data.
- For FIR images, 16 bit heat bitmaps are exportable directly to MATLAB or utilized by vendor software to produce false colour images of temperature. Average temperature of user -defined areas are reported, or average temperatures of plants batch processed from thresholded temperature maps are recorded.
- A flexible Windows type graphical user interface is provided.



Features and specifications of the PlantScan hardware and software have been developed in consultation with plant scientists in Canada, Australia, the Czech Republic and the United Kingdom. Clients for our imaging systems include:

**The High Resolution Plant Phenomics Centre, Canberra**

**The Australian National University**

**BASF**

**Monsanto**

**Pioneer-Dupont**

**Purgenessis**

and numerous other companies, research institutes and universities worldwide.

## Development Team Leaders

PlantScan and associated technologies have been developed, and are supported, by a team of scientists and engineers with decades of research experience in plant science:

**Dr. Stephen Hunt** President and CEO of Qubit Systems Inc. Adjunct Professor, Queen's University, Kingston, Canada. Published extensively in the fields of photosynthesis, respiration and nitrogen fixation.

**Dr. Monika Kuzma** Chief Scientist at Qubit Systems Inc. Former Head of Trait Discovery at Performance Plants Inc., specializing in stress tolerance mechanisms.

**Mr. Martin Trtilek** CEO Photon Systems Inc. Co-developer of the first commercial fluorescence imaging system. Numerous innovations and publications in chlorophyll fluorescence and related technologies.

**Dr. Lada Nedbal** Co-founder Photon Systems Inc. Head, Dept. Biological Dynamics, Institute of Systems Biology and Ecology, Academy of Sciences of the Czech Republic. World leader in dynamics and modeling of photosynthesis as determined by chlorophyll fluorescence analysis.



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