Design and Operation of a Multiple-Chamber Gas-Exchange System for Plant Communities

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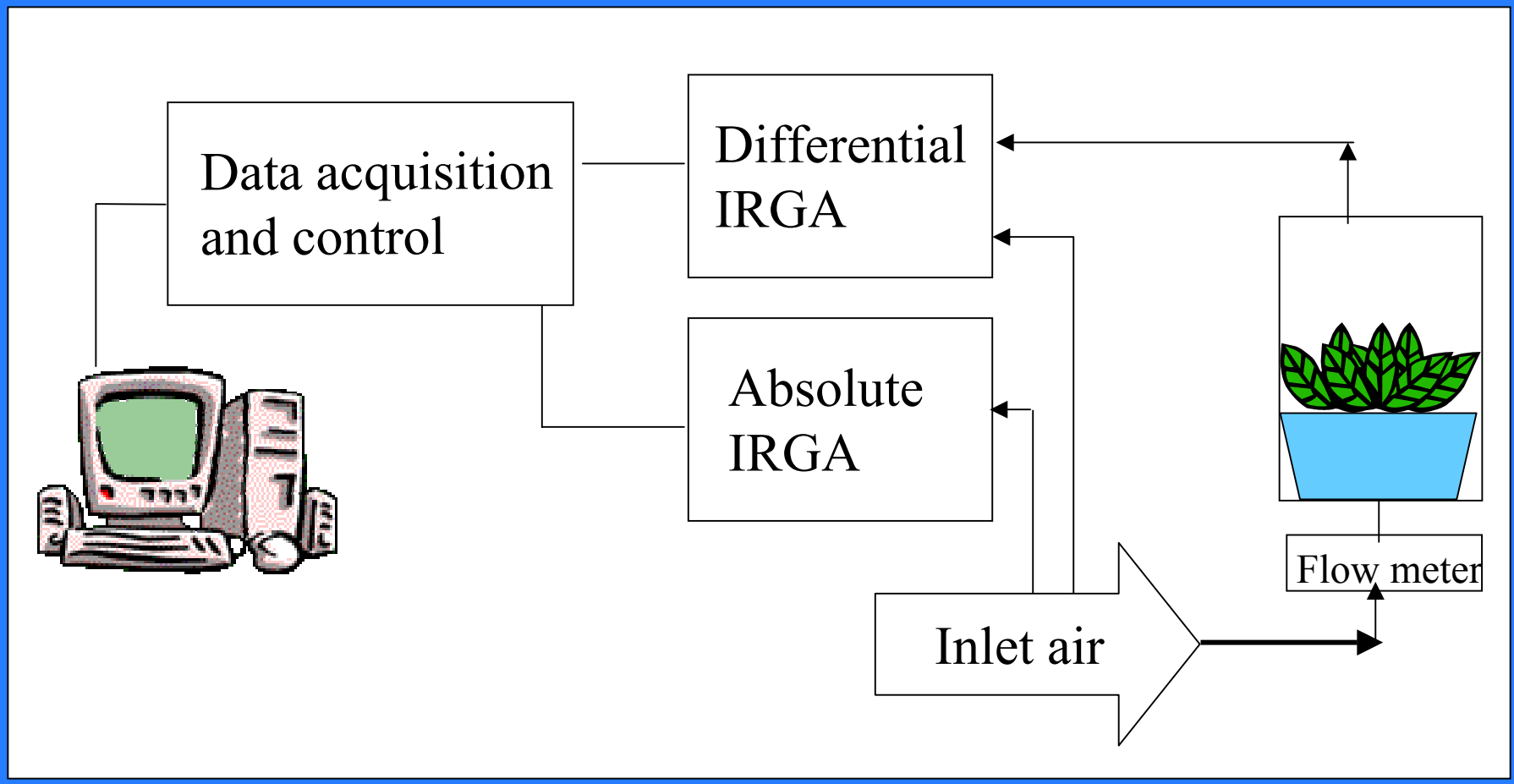
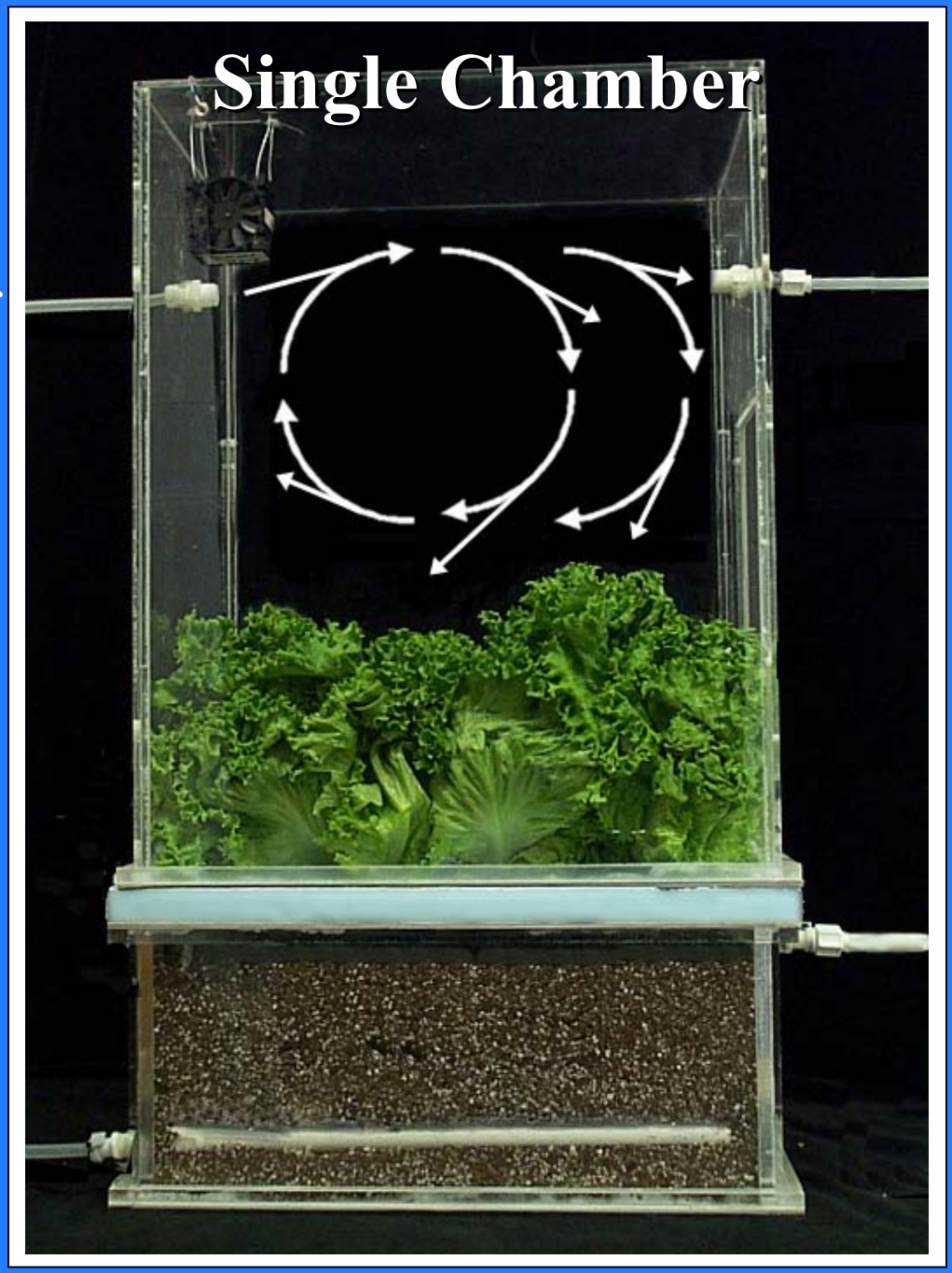
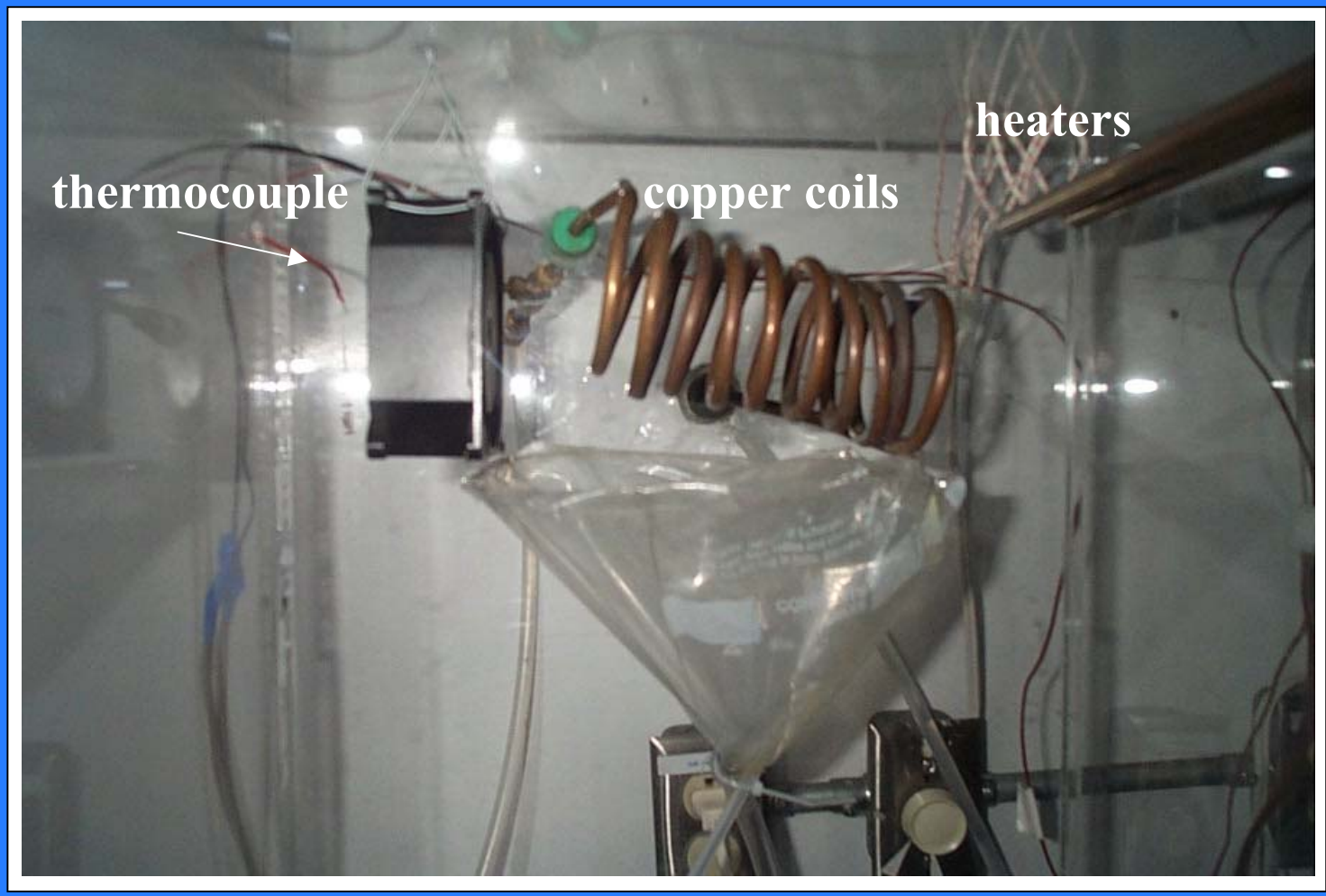


Diagram of a single-chamber gas-exchange system. Our data acquisition and control system allows for automation of most day-to-day operations

This is a side view of a single chamber. A fan at the top of the chamber with a flow of 1000 LPM quickly mixes incoming air so that a representative sample can be made.



Chamber temperature control



A copper coil and 15-W heaters provide temperature control to within 0.2C of the set point.

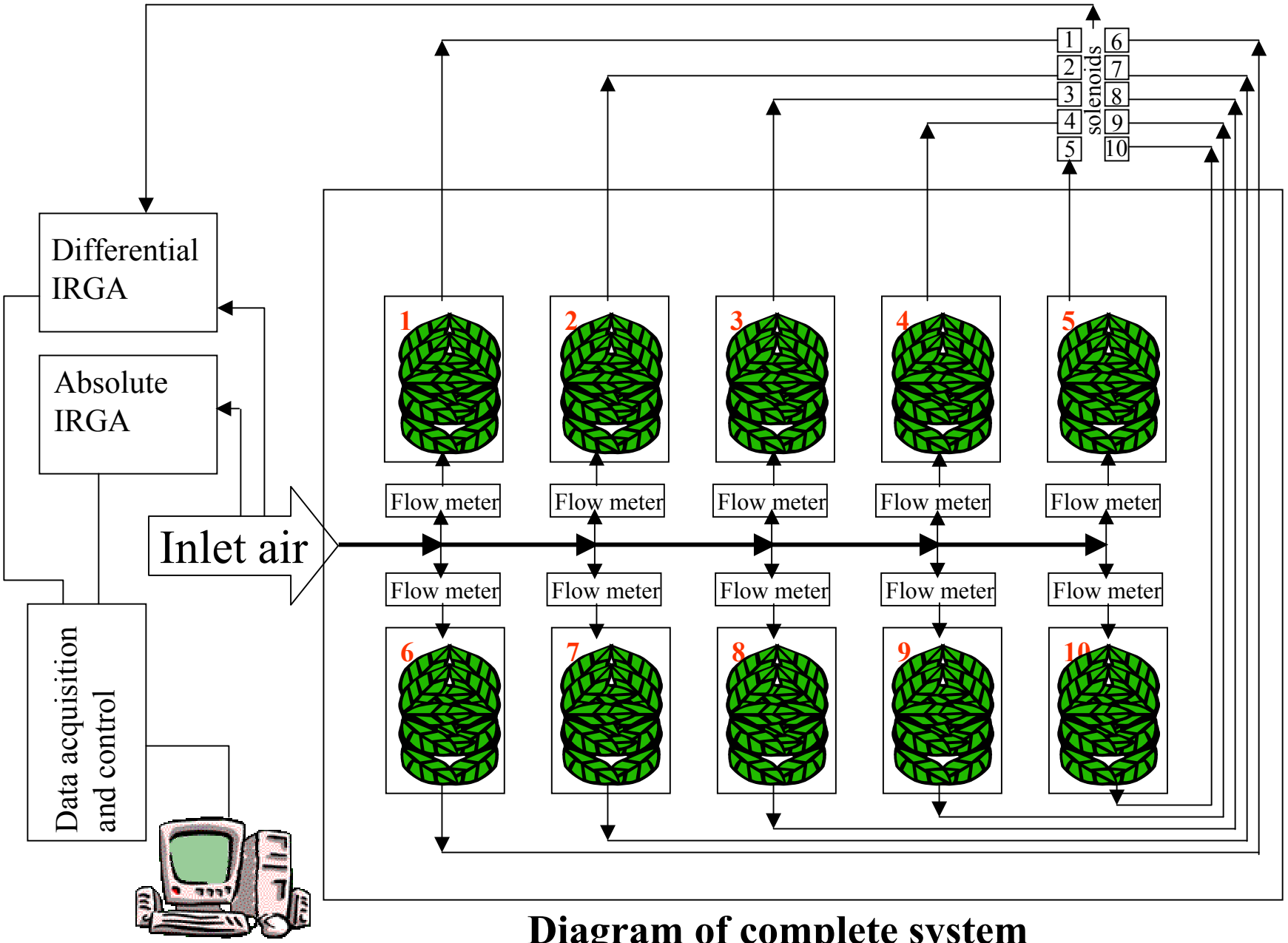
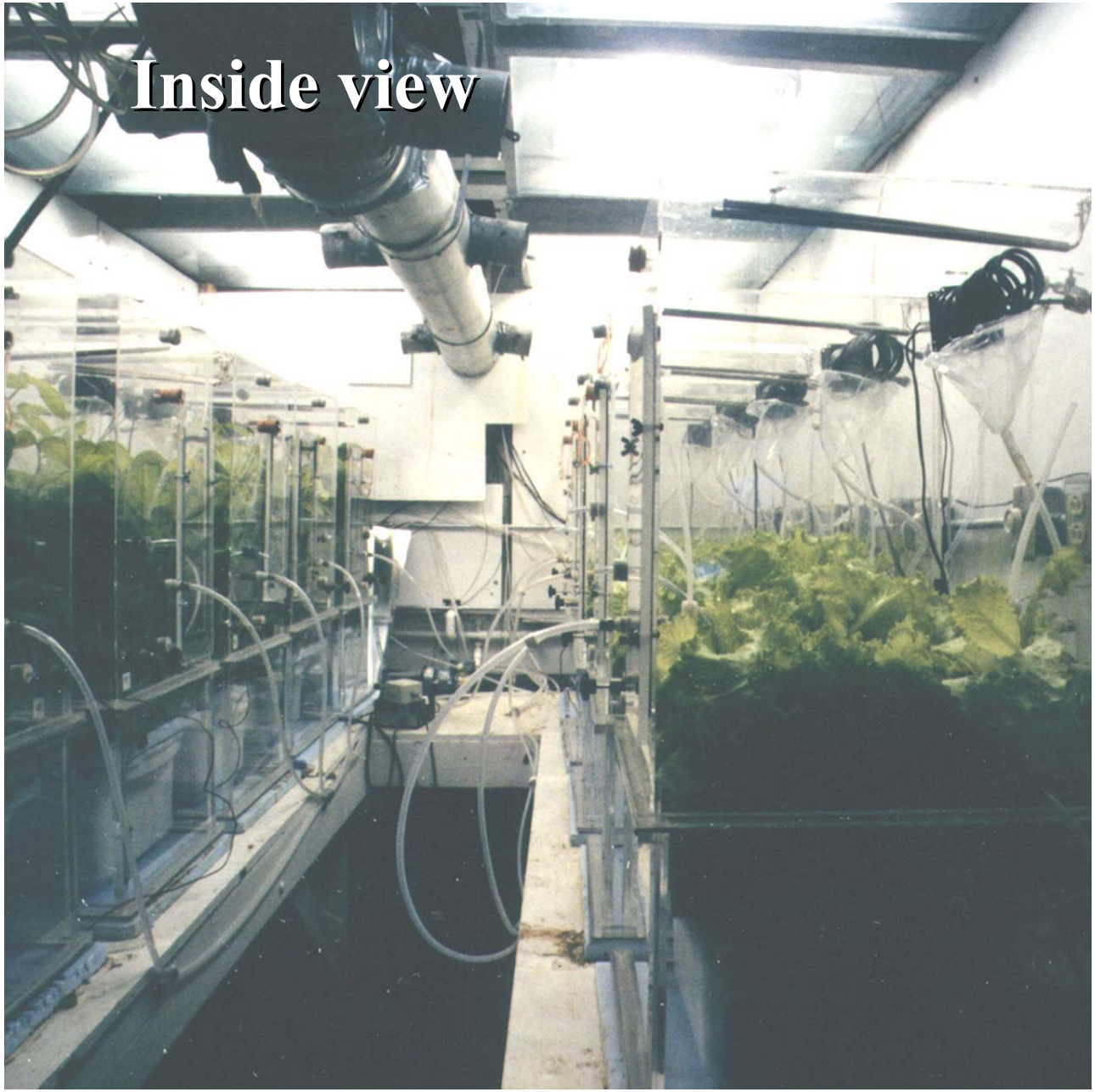


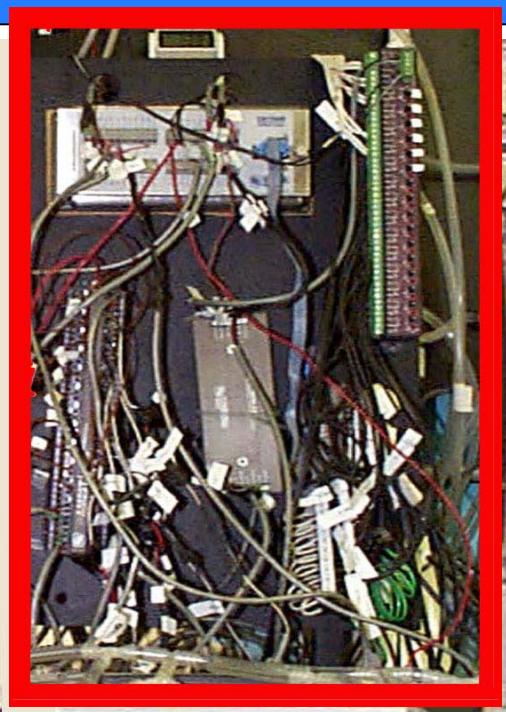
Diagram of complete system

Inside view



Reflective Mylar skirts surround each chamber to reduce the side lighting in these small canopies.

Control Center



The entire system is managed with a single Campbell Scientific datalogger with two multiplexer and controllers interfaced with a PC.

Tomato
'Micro-Tina'

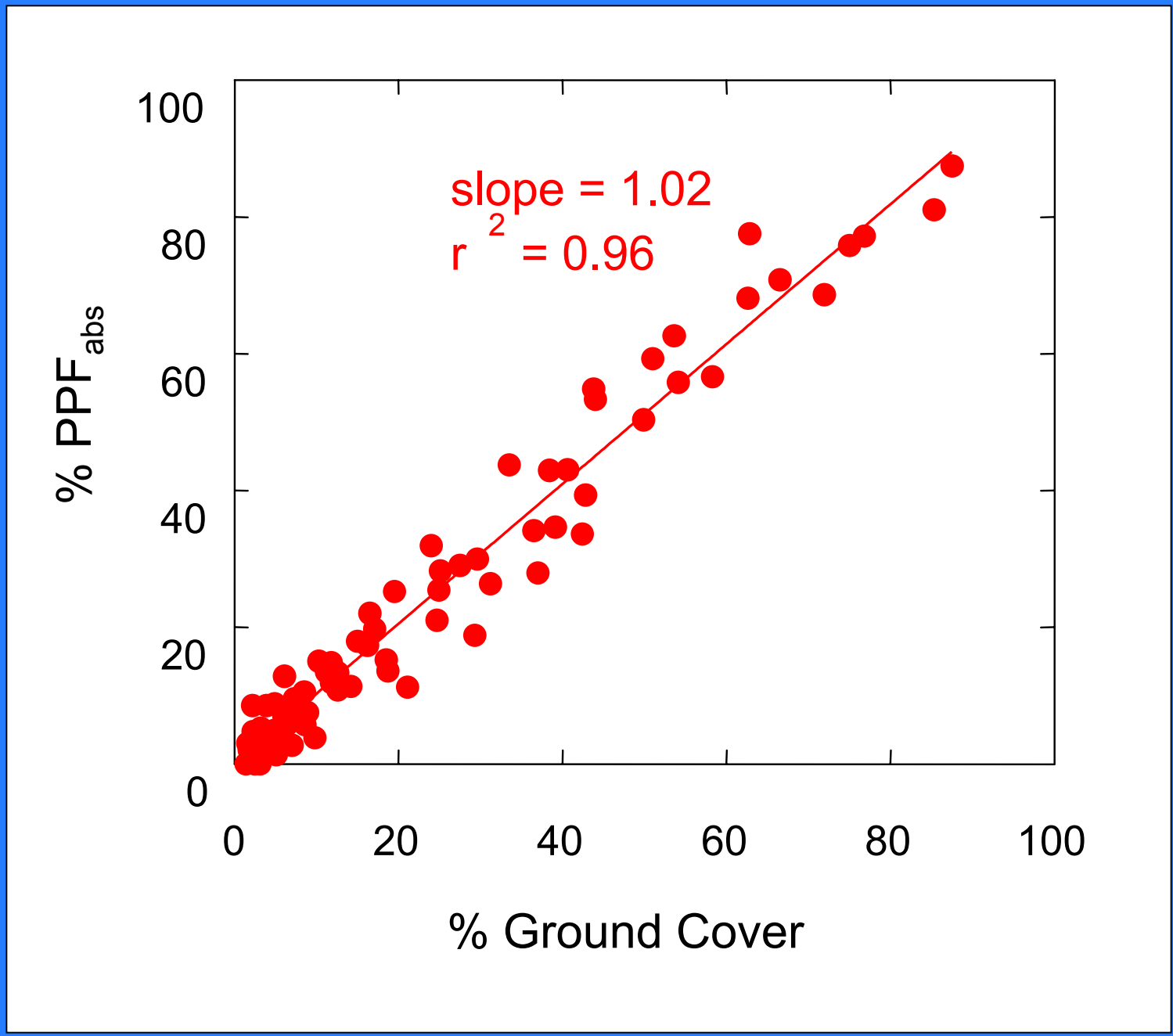
Lettuce
'Grand Rapids'

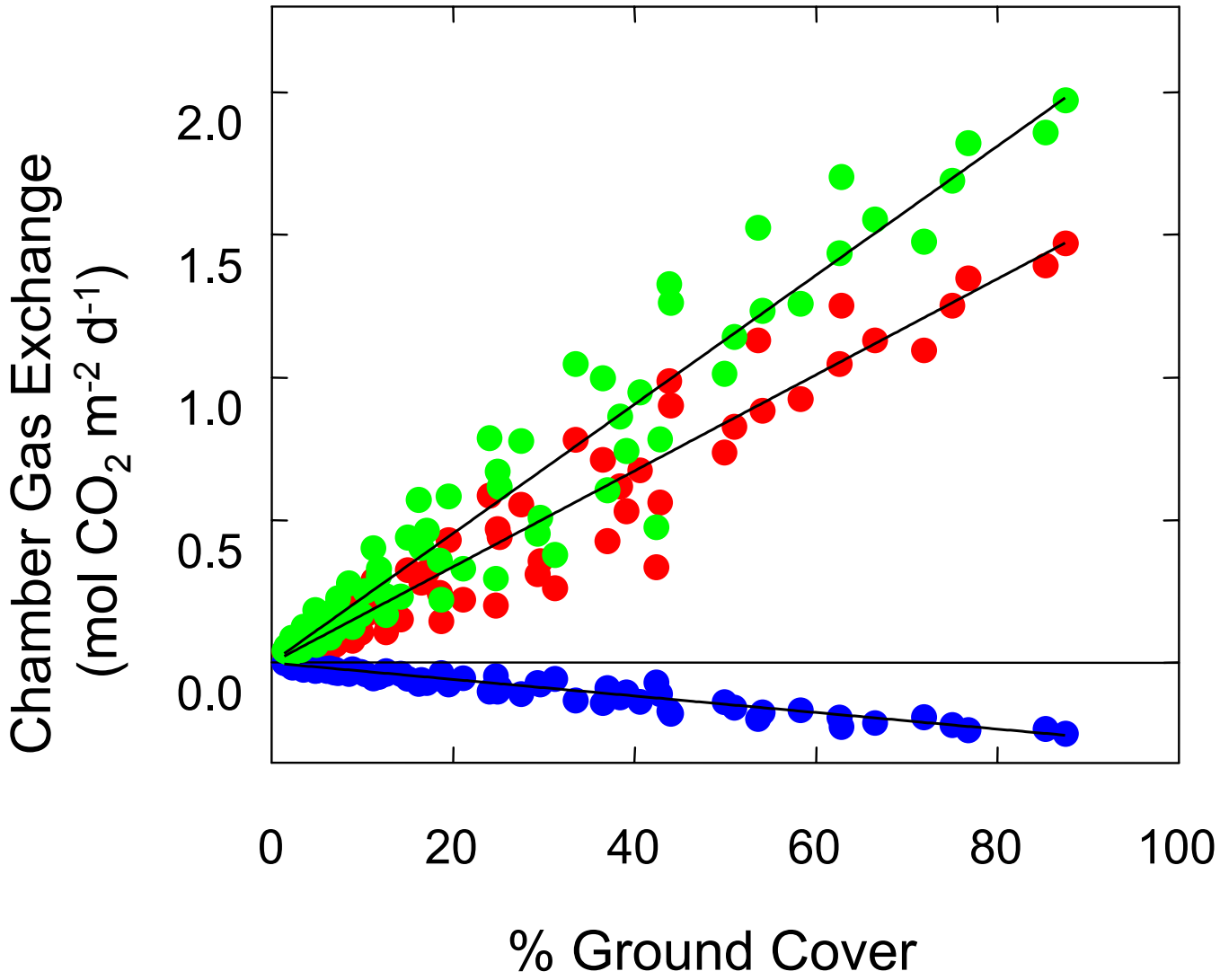
Soybean
'Hoyt'

Short cultivars like these, 'Apogee' and 'Perigee' wheat, 'Super Dwarf' rice and 'Triton' peppers can be grown to maturity in these small chambers.

Digital Imaging

The individual chambers provide a convenient plot size to image canopies from above to determine radiation capture or percent ground cover with a digital camera and Photoshop-type software.


slope = 1.02
r 2 = 0.96
% PPFabs
% Ground Cover
0
20
40
60
80
100



There is an excellent correlation between photosynthesis and respiration with percent ground cover, so digital imaging can provide a cheap, non-destructive method of predicting growth.