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*pheno*PET: Observing Carbon Transport within Individual Plants

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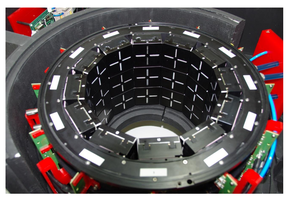
Motivation

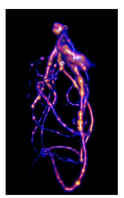
Investigating carbon allocation patterns in plants is crucial for understanding development of plant biodiversity. Yet, little is known about assimilate transport velocities, because literature values from singular and destructive measurements are hardly representative.

We developed a dedicated scanner (*pheno*PET) and applied positron emission tomography (PET) with Carbon-11 (^{11}C) as tracer to determine tracer transport velocities in different plant types, plant parts during a day or over days.

The *pheno*PET Scanner



Detector Ring

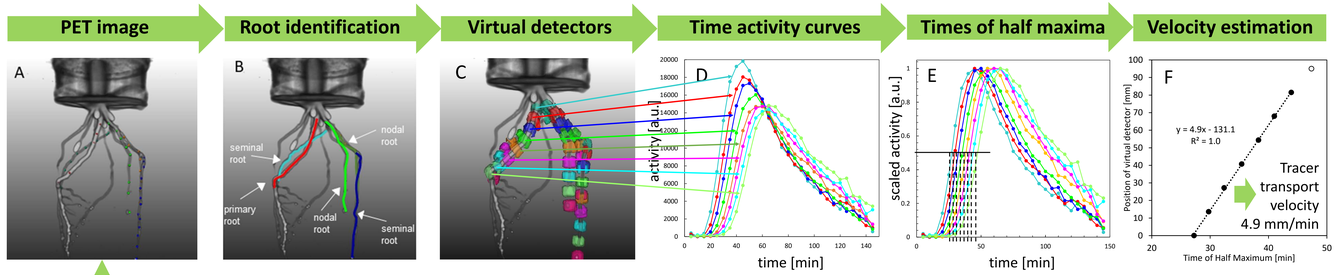


PET image (pea root)

- Field-of-View: 18cmØ x 20cm height
- Spatial Resolution: 1.6mm
- Minimal Time Frame: ≤ 1 min.
- Image reconstruction with PRESTO software [1].
- System comprises all necessary corrections and provides fully quantitative results [2,3].

Workflow

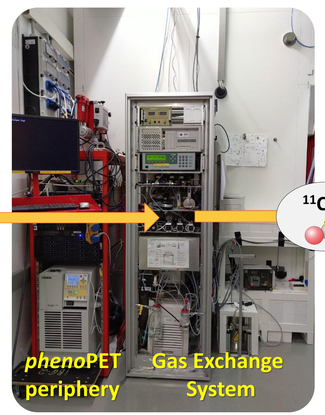
Evaluation [4]



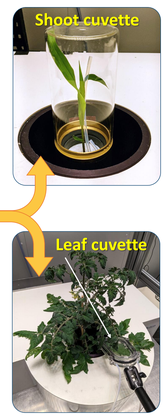
Quantitative Image Reconstruction

Measurement

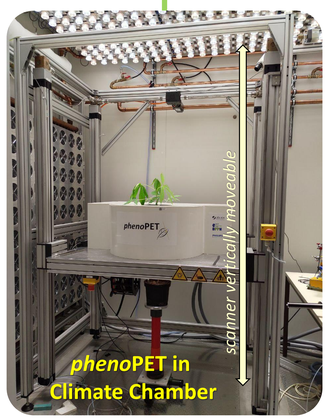
Cyclotron for $^{11}CO_2$ production



The Gas Exchange System administers a defined amount of $^{11}CO_2$ to the plant (typ. 50MBq).



CO_2 is either applied to the shoot or a leaf.

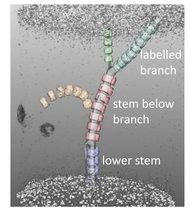


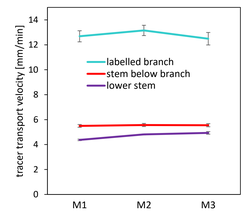
Control of Temperature, Humidity, Light and also "Wind" Effect.
Scan Time: typ. 2.5h.

Results

Tomato shoot

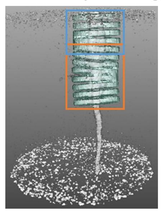
Velocities differ between branch and stem

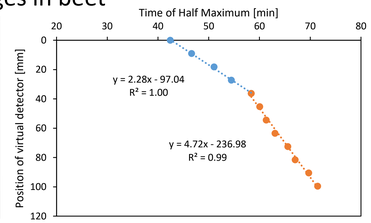




Sugar beet

Velocity changes in beet





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