

Hyperspectral Image Fusion for the Study of Rice Leaf Tissue

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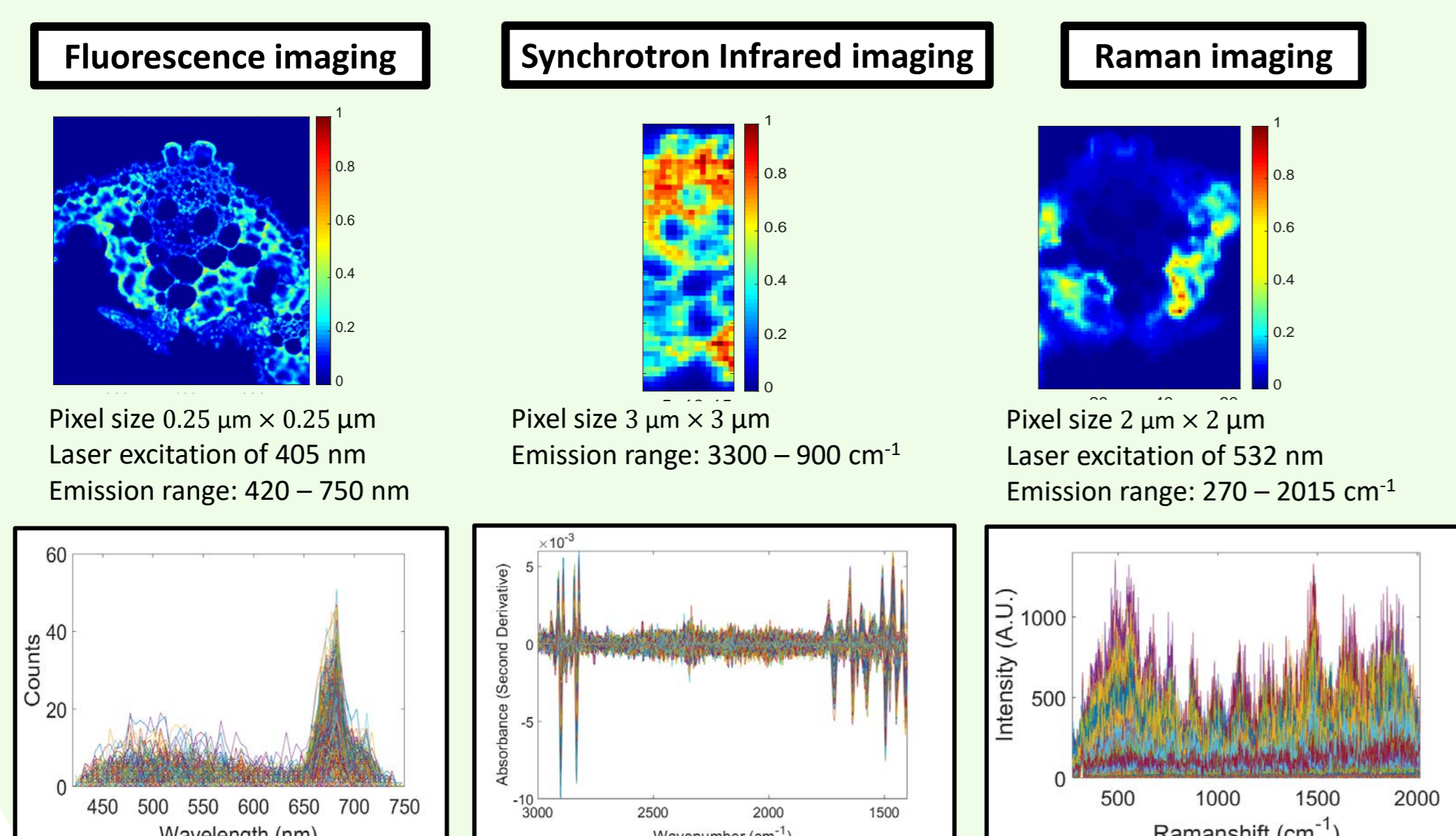
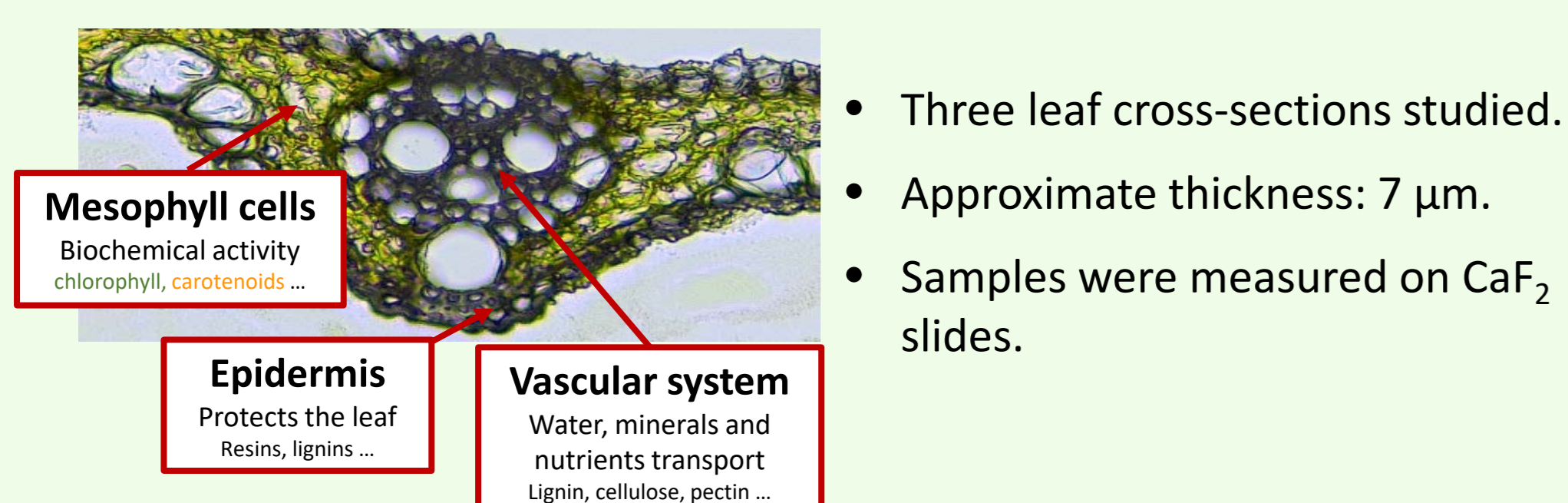
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Introduction

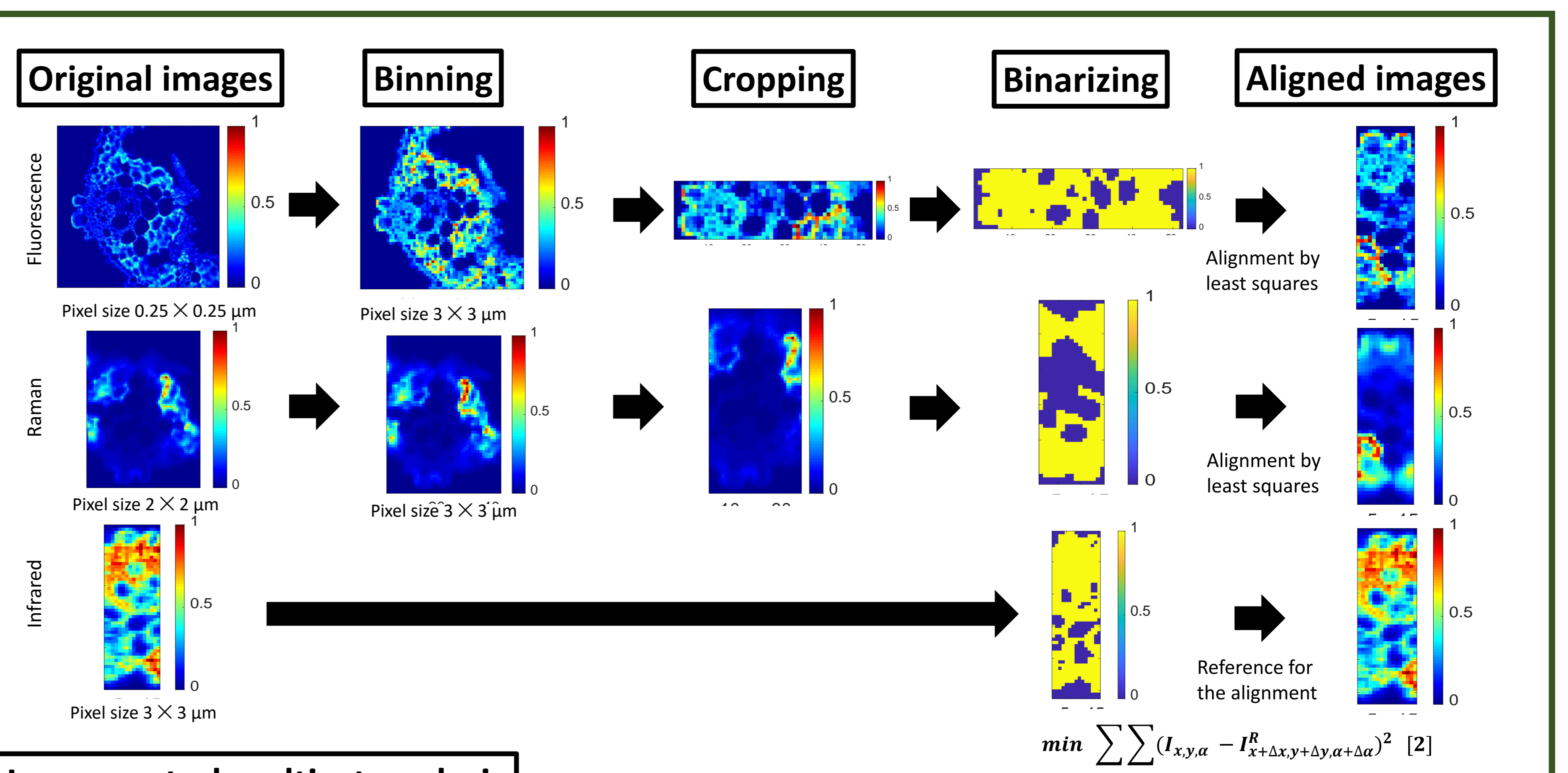
Hyperspectral images (HI) are formed by pixels related to spectra. The analysis of HIs with multivariate curve resolution alternating least squares (MCR-ALS) provides the signatures of the pure spectra S^T and the distribution maps C of the components of the sample [1]. In this work, fluorescence images, infrared synchrotron images and Raman images have been fused to study natural components in transverse sections of rice leaves (*Oryza Sativa Japonica Nipponbare*).

Experimental workflow

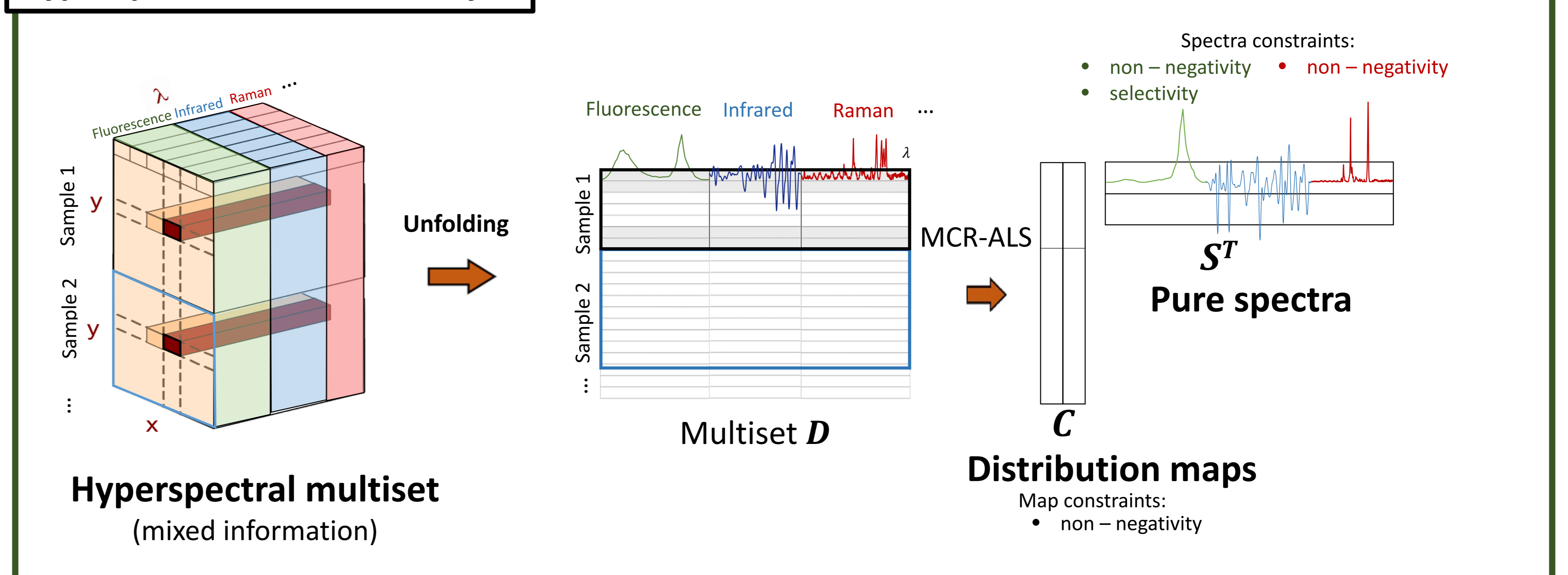
Optical image of a rice leaf cross-section.



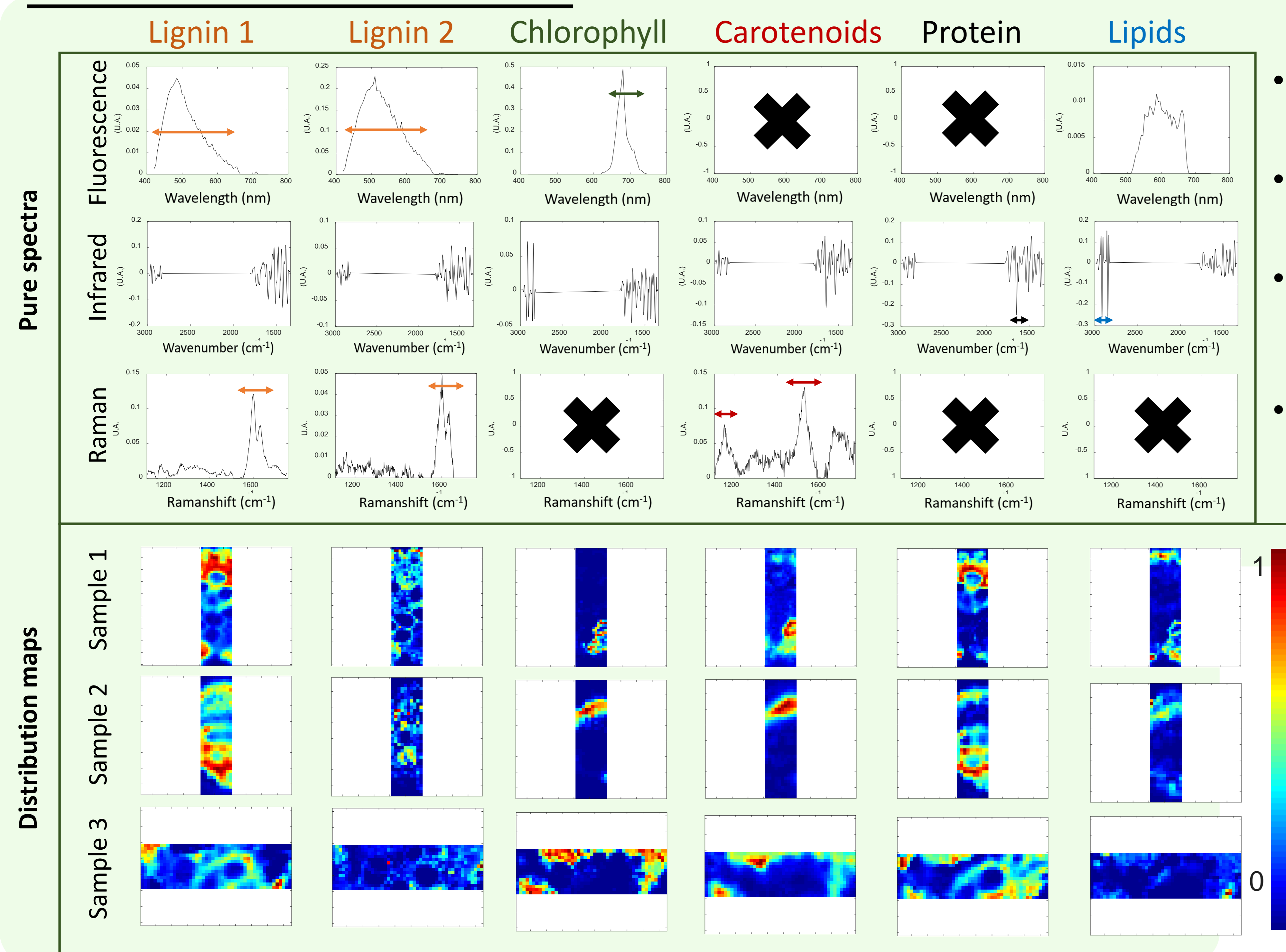
Data treatment



Hyperspectral multiset analysis



Results and discussion



- Six components were characterized: two types of lignins, chlorophyll, carotenoids, proteins and lipids.
- The complementary information of fluorescence, Raman and Infrared provides a better definition of all compounds.
- Infrared spectroscopy provides a fingerprint for all components, whereas Raman and fluorescence give signatures with clearer interpretability.
- Resolved spectral signatures could be further used to recover the full image maps of constituents of the original samples.

Conclusions

- The fusion of different techniques has provided complementary information on the components and allowed the complete characterization of the components in the rice leaf.
- Future research will imply using incomplete multiset to preserve the original spatial resolution of images and to recover the maps of the cropped image regions.

References

1. De Juan, A.; Tauler, R. Multivariate curve resolution-alternating least squares for spectroscopic data. In *Data Handling in Science and Technology*. Elsevier. 2016, 30, 5-51.
2. Piqueras, S.; Maederb, M.; Tauler, M.; de Juan, A. A new matching image preprocessing for image data fusion. *Chemom. Intell. Lab. Syst.* 2017, 164, 32-42.

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